



AN INVESTIGATION OF THERMOPLASTICS FOR USE AS 20mm ROTATING BANDS

UNIVERSITY OF DAYTON RESEARCH INSTITUTE DAYTON, OHIO 45409

NOVEMBER, 1975

TECHNICAL REPORT AFML-TR-75-186
TECHNICAL REPORT FOR THE PERIOD OF DECEMBER, 1973 — JULY 1975

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AIR FORCE WRIGHT AERONAUTICAL LABORATORIES
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio 45433

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This technical report has been reviewed and is approved for publication.

EDWARD J. MORRISEY

Project Monitor

FOR THE COMMANDER

ALBERT OLEVITCH, CHIEF

Materials Engineering Branch Systems Support Division

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	7. AUTHOR. 10 D. R. Askins 15	8. CONTRACT OR GRANT NUMBER(5) + 33615-74-C-5924
	9 PERFORMING ORGANIZATION NAME AND ADDRESS University of Dayton 300 College Park Dayton, Ohio 45469	PROGRAM ELEWENT PROJECT TASK AREA & WORK UNIT NUMBERS 7381/01/34
	Materials Engineering Branch (MXE) Systems Support Division (MX)	Now 175 (2)
	AF Materials Laboratory (AFML) 14 MONITORING AGENCY NAME & ADDRESS(If different from Controlling Office) AF Materials Laboratory Air Force Systems Command	15 SECURITY CLASS. (of this report) UNCLASSIFIED
	Wright-Patterson AFB, Ohio	15a. DECLASSIFICATION DOWNGRADING SCHEDULE
	16 DISTRIBUTION STATEMENT (of this Report)	
(14)	Approved for public release; distribution unlined HF-7381 (17) 738141	mited,
	17 DISTRIBUTION STATEMENT (of the abstract entered in 81-ch 10) Williams From NONE	Report)
	18 SUPPLEMENTARY NOTES NONE	
	19 KEY WORDS (Continue on reverse side if necessary and identify by block number)	
	Rotating bands, plastic, 20mm, bonded, deve gunfire, thermoplastics, adhesives, injection	
	An empirical investigation has been conducted to of plastic and adhesive candidate materials for systems. Eighteen different polymeric materia eral polymer families were used as rotating ban sives representing eight general types were util materials to provide a total of forty-nine band n	use in 20mm rotating band ls, representing seven gen- ids. Eleven different adhe- ized with the eighteen band

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tions. Numerous processing variables were also investigated with the result that a total of one hundred thirty-one processing/material combinations were tried.

The net results of this investigation was the identification of four material combinations which demonstrated substantial promise of serving as alternate materials to the nylon 12-253P rotating band system. Three of these four employ a domestically produced nylon 6 material (Zytel 211) with three different adhesives, P104, P-3, 253P. The fourth is a French produced nylon 11 material (BMNO) with the 253P adhesive. Gunfire results are presented and discussed and recommendations for following up the work conducted in this program and optimizing the performance of the most promising materials are made.

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PREFACE

This final report was submitted by the University of Dayton Research Institute, Dayton, Ohio under contract number F33615-74-C-5024, 7381/01/34, with the Air Force Materials Laboratory, Wright Patterson Air Force Base, Ohio. Mr. E.J. Morrisey was the laboratory project monitor.

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I. INTRODUCTION & BACKGROUND

A rotating band is that part of a projectile which extends above the diameter of the basic projectile body and which engages the lands and grooves on the interior of rifled gun barrels. It consists of a relatively soft material which must serve as a seal to prevent gaseous products of propellant combustion from escaping around the projectile and must be firmly anchored to the projectile to impart spin as the projectile accelerates through the gunbarrel. In addition, the rotating band must possess sufficient integrity that it does not fray, crack, or break up either in the gunbarrel or in free flight after exiting the barrel.

The United States has been using relatively soft metals such as copper for many years for rotating bands. There are a number of disadvantages associated with the use of metallic rotating bands but the problems become most pronounced at high rates of fire and high muzzle velocities. Under these conditions one of the major problems becomes gunbarrel wear or erosion. This situation has been recognized for many years and a substantial effort has been invested over the years to investigate and develop alternate materials to the soft metals for use as rotating bands. These efforts are well summarized in a number of publications [1, 2] and will not be further reviewed here. The University's involvement in an investigation of this nature commenced in December of 1973 and continued until July, 1975, concentrating on the 20mm projectile.

At the time the writer became involved in the program, the status of the program was that:

- (a) Nylon 12 had been found to work adequately but it was not manufactured domestically and was expensive. It was desired that a less expensive material which was domestically manufactured be found.
- (b) A less expensive molding technique than ring-gate/insert molding was desired.

Item (b) had already been addressed by the Materiais Engineering Branch (MXE) of the Air Force Materials Laboratory (AFMI). The proposed solution employed an improved mold design to reduce material waste and machine time. The new technique employs side gating and produces weld lines where the molten polymer flows around the projectile from opposite sides and meets. Weld lines are reputed at best to be only 80 to 90% as strong as weld free portions of the band [2] but in our experience, no failures whatsoever have been associated with the weld lines. The original objective of the effort reported here, consequently, was to investigate alternative materials and adhesives so as to replace nylon 12 with an inexpensive, domestically available band material. Several considerations changed during the course of the program. One of the earliest changes was the dropping of the expense criteria. The desire was to simply find a domestically available alternate to nylon 12, regardless of cost. This was to be accomplished by using a one-half inch long band with no bevel on either the leading or trailing edges, even though it was already known at this time that a bevelled angle on both the leading and trailing edges improved band performance. It was also learned, several months into the effort, that the ultimate band length would have to be reduced to 0.28 inches instead of 0.50 inches. Since by this time a 0.50 inch mold insert was available, it was agreed that work could proceed using the 0.50 inch length. The primary aim at this point was to find a material equivalent or superior to the nylon 12 material, and it was felt that this could be accomplished with the 0.50 inch band length simply by comparing the performance of 0.50 inch nylon 12 bands to that of 0.50 inch bands of the various candidate materials.

II. TECHNICAL DISCUSSION

A. Approach

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At the time that the University became involved in this program, no quantitative information was available regarding the strength, toughness, or other property levels required of the band material or adhesive in order to achieve acceptable performance over the required temperature range (-(5°F to 160°F)). Further, only a qualitative, and even for that matter relatively speculative, idea existed regarding the loading modes which a rotating band and its adhesive would be subjected to during gunfire. The approach adopted therefore was largely an empirical one guided by the judgment and experience of the author and the AFML program monitor. In general, materials were sought which possessed and retained down to -65°F, a degree of impact resistance comparable or superior to the nylon 12 material. For each band material investigated, one or more adhesives were tried. The adhesives tried were either recommended by the band material supplier or were members of the general class of adhesives recommended for use with that type of material [3].

B. Materials Investigated

During the course of the experimental effort, eighteen specific thermoplastic band materials, representing seven general families of polymers, were investigated. Eleven specific adhesives representing eight general types were utilized during the program as well as four different adhesive primer materials. A total of forty-nine band material/adhesive/primer combinations were fabricated and evaluated. Superimposed upon this total were numerous processing variations such as projectile surface preparation and adhesive/primer curing schedule. The total number of different processing/material combinations examined therefore ran well over one hundred. Tables A-1 through A-3 list the materials used in this program while Table A-4 lists the material/adhesive/primer combinations investigated.

Appendices A and B summarize the materials and processing combinations investigated in this program.

C. Fabrication Procedures

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All of the rotating bands evaluated during this program were injection molded on a Newbury-Eldorado, 75-ton, 3-ounce injection molding machine. The molding parameters used to fabricate all the various sets of rotating band samples are tabulated in Appendix B. Any subsequent adhesive bonding operations to which the banded samples were subjected to culminate bonding are also presented in Appendix B.

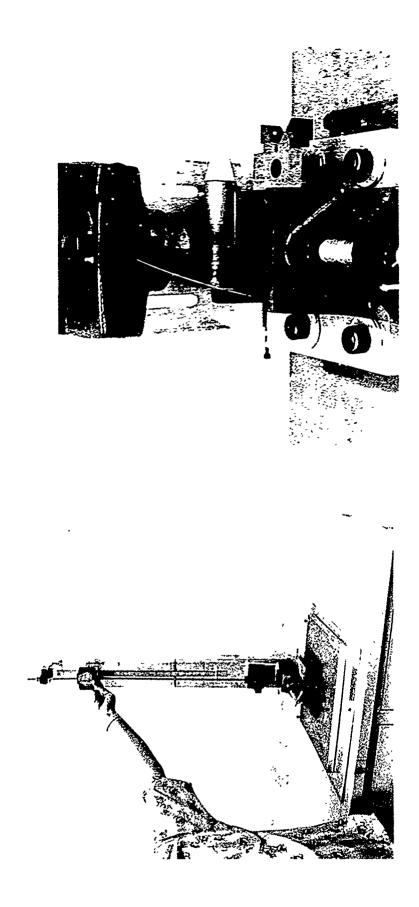
In essence, the sample fabrication process consisted of four general phases. The first consisted of the preparation of the projectile surface for bonding. This phase consisted or a number of substeps including grit or glass bead blasting, methyl ethyl ketone (MEK) degreasing and air drying. The second phase consisted of application of the adhesive. This could have been a simple dip or brush coating or the wrapping and heat tacking of a tape-type adhesive onto the surface. In some cases, a base primer coat had to be applied before the adhesive itself and in some cases the adhesive required a bake after application but prior to molding of the band. The third phase was the injection molding of the band itself while the fourth phase was the post molding bond completion. Although in most cases, the adhesive application, molding and bonding corditions recommended by the manufacturer were utilized, some variations in these processing parameters were introduced during the course of the program with some of the band materials and adhesives. These variations were aimed at improving the performance of the various systems over that achieved with the recommended processing conditions. For the most part, the specific details of the processing of the various band and adhesive combinations will not be discussed in the text since this information is quite cumbersome and can be obtained from Appendix B if desired. In a few instances however, salient variations in the processing parameters which led to significantly improved or reduced performance levels will be discussed.

D. Testing and Evaluation Procedures

Early in the program, it was requested that some sort of screening technique be developed and utilized to simulate the effects of gunfire testing and reduce the number of gunfire tests required to evaluate the various materials. A falling-dart type impact tester was suggested as having served this purpose well in other similar studies. Accordingly, a falling-weight impact tester already available at the University was modified for this purpose. Figure I illustrates this test device. It is capable of dropping a one, two, or four pound weight from any height up to eight feet onto a sample. The sample rests in a V-block and is impacted by a blunted knife edge 0.0735 inches wide, a dimension comparable to the width of a rifling land. The length of the knife edge is one inch, which is longer than the band, and is aligned along the projectile axis so that the excess length serves to limit penetration to the surface of the main projectile axis, the same situation encountered in a gunbarrel.

A series of falling dart tests on nylon rotating band specimens was conducted early in the program to determine if any difference in performance was manifested with various combinations of dropping weight and drop height. It was found that for equivalent impact energy, equivalent band performance was obtained, regardless of the combination of weight and drop height used to attain the impact energy. Consequently, all further screening tests were conducted with a four pound weight, different impact energies being achieved simply by varying the drop height.

The falling dart impact test described above was used to screen the many materials examined during the course of this effort and to identify those which looked promising enough for further evaluation in an actual gunfire test. The gunfire tests were conducted at the Air Force Armaments Laboratory (AFATL), Eglin AFB, Florida. Barrel number 23, a 30/20 barrel with a constant twist of one twist in 24 inches was employed. Thirty millimeter cartridge cases were employed to achieve the desired velocities



(a) Total view, showing falling mass, guide rod, impact nose, specimen, and base.

(b) Closeup, showing impact nose resting on banded sample in V-block.

Figure 1. Falling Dart Test Apparatus

but were necked down to 20 millimeters to accommodate the projectiles. Tests were conducted at a nominal muzzle velocity of 4000 fps. Maximum chamber pressure and projectile exit velocity were recorded during the test and an in-flight photograph of the specimen was taken to permit inspection of the condition of the rotating band after its exit from the barrel. Tests were conducted at room temperature, -65°F, and 165°F. Figures 2 and 3 represent typical in-flight photographs illustrating the various types of rotating band conditions seen in a gunfire test and which are discussed in the text and listed in Appendix C. Table 1 lists the specifics for each specimen photograph in Figures 2 and 3 so that the reader may cross reference the photographs and the test results tabulated in Appendix C.

Use of a constant-twist barrel is an admittedly more severe test condition than the projectile would see in a gain-twist barrel, which is the type in service. The rationale for using the constant-twist barrel, however, was that since it did represent the more severe condition, a material which performs successfully in this situation would have a built-in margin of safety in the less taxing gain-twist system. Late in the program effort, some shots were fired with a gain-twist barrel and as expected, band performance was significantly better.

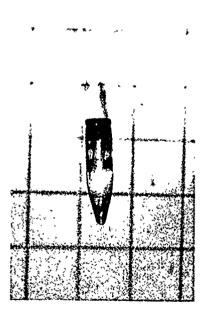
Examination of all the test data accumulated during this program from both the falling dart and gunfire tests leads to a number of conclusions regarding correlation of material performance in the two different tests. First, it must be noted that, by far, the bulk of the falling dart tests were conducted using an eight foot-pound impact energy. This level was selected because the nylon 12-253P system was capable of surviving falling dart impacts at this energy level at all three test temperatures (-65°F, 72°F, 165°F) without fracture or debonding. It was reasoned that since we did not know what impact energy level corresponded to a material's ability to perform satisfactorily in a gunfire test, selection of an impact energy level which the nylon 12-253P (the best gunfire performance found to date)

TABLE 1

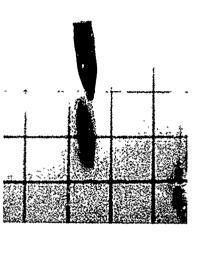
SPECIMEN NUMBER, MATERIALS, AND TEST CONDITIONS
FOR IN-FLIGHT PHOTOGRAPHS OF FIGURES 2 AND 3

AFATL Shot No.	Specimen Number	Band/Adhesive Combination	Test Temp.	Interpretation of Photograph
685	80-22	BMNO/253P	75 ⁰ F	Pass - Band fully intact.
431	75-14	Zytel 158/253P	75 ⁰ F	Pass - Slight fray- ing at rear edge.
418	76-12	Zytel 158/P3	75 ⁰ F	Fail - Small piece off rear edge.
383	90-17	Zytel 211/253P	75 ⁰ F	Fail - Large piece lost.
365	75-3	Zytel 158/253P	75 ⁰ F	Fail - Entire band lost.
416	90-82	Zytel 211/253P	75 [°] F	Fhoto blurred - band looks intact but may be slightly frayed.
417	76-11	Zytel 158/P3	75 [°] F	Photo blurred - band looks intact but may be very slightly frayed.

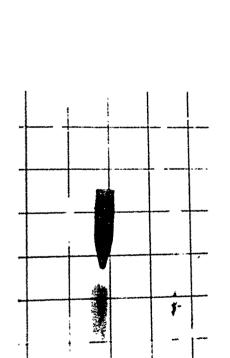
could withstand would serve as a useful starting point. In retrospect, it appears that the use of eight foot-pounds impact energy does provide a fairly reliable indication at 72°F of a material's ability to perform well in gunfire tests at 72°F. At -65°F, however, the falling dart impact test using eight foot-pounds appears to be too severe a condition since every combination tested with the falling dart apparatus at this temperature except for the nylon 12-253P system experienced fracture or debonding or both. Some materials which looked poor in the falling dart tests at -65°F, however, looked rather encouraging in gunfire tests at this temperature. At 165°F, on the other hand, most materials tested with the falling dart looked quite suitable, although these same materials did not perform as consistently well in gunfire tests at this temperature. What all this means is that these materials may not be as good as the nylon 12-253P system in resisting this type of impact, particularly at the lower temperature, but that they still may be good enough to survive a gunfire test. The fact that a falling dart impact test is strictly a compressive test while a rotating band during gunfire sees not only compressive but also shear stresses undoubtedly contributes to this less than perfect correlation between the two. All of these considerations indicate a need to know the actual stress levels encountered by a rotating band during gunfire at different temperatures and how various combinations of material mechanical properties affect and respond to these stresses.



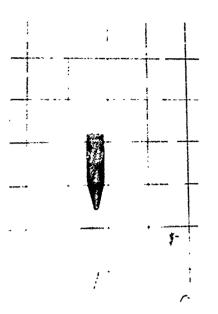
(a) Shot No. 685 - Pass; band fully intact.



(b) Shot No. 431 - Pass; slight fraying at rear



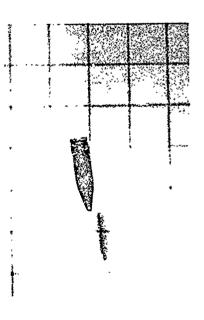
(c) Shot No. 416 - Photo blurred; band looks intact but may be slightly frayed.



(d) Shot No. 417 - Photo blurred; band looks intact but may be very slightly frayed.

Figure 2. Typical In-Flight Photographs of Gunfire Test Specimens.

(b) Shot No. 383 - Fail; large piece lost.



(c) Shot No. 365 - Fail; entire band lost.

Figure 3. Typical In-Flight Photographs of Gunfire Test Specimens

(a) Shot No. 418 - Fail; small piece off

rear edge.

E. Experimental Results

As mentioned in Section IIB, a total of forty-nine band/adhesive/ primer combinations were fabricated and evaluated, and the number of processing variations superimposed upon this total brought the total number of processing/material combinations to over one hundred. Each of these combinations were screened with the falling dart test to see how well they performed in comparison with the best material found to date, nylon 12 bonded with 253P adhesive primer. The screening tests were conducted at 72°F and any material performing well at this condition was then impacted at -65°F and/or 165°F. Only those materials which looked promising in the falling dart screening test were forwarded to AFATL for gunfire testing.

Most of the materials fabricated and screened during this program did not perform well in the falling dart tests, experiencing either band fracture or debonding from the projectile substuate as a result of the impact. Rather than expand individually on the test results for each single material and processing variation, the results for all the materials are summarized in Appendix C. Only those systems which appeared promising and were sent to AFATL for gunfire tests will be discussed individually in the text, with brief summaries of the results for other systems presented in the conclusion section starting on page 26. This reduces the descriptive task to manageable proportions since only eight combinations were subjected to gunfire testing at AFATL. All of these eight combinations involved nylon bands (nylon 6, nylon 6/12, nylon 11, and nylon 12) and epoxy-phenolic (P3 and P104) or a proprietary epoxy type (253P) adhesive. One of the eight was the nylon 12/253P combination which has proven to be the best material system found to date for 20mm rotating bands fired at 4000 fps. Table 2 lists the eight combinations which will be individually discussed.

TABLE 2

ROTATING BAND SYSTEMS EVALUATED IN GUNFIRE TESTS AT AFATL

Band Material	Material Designation	Adhesive
Nylon 12	L1901	253P
Nylon Il	BMNO	253P
Nylon 11	BMNO	P3
Nylon 6/12	Zytel 158	253P
Nylon 6/12	Zytel 158	P3
Nylon 6	Zytel 211	253P
Nylon 6	Zytel 211	P3
Nylon 6	Zytel 211	P104

L1901-253P

At the time that the University became involved in this effort, the nylon 12/253P system had already established itself as the best performing system yet tested. It's performance was reputed to be fully adequate at ambient conditions and at -65°F, but at 165°F it's performance was not fully satisfactory due to softening. Further, since the material was not domestically manufactured, the whole object of our program was to find a domestically produced alternative. As a first step, however, several series of rotating bands using this material were fabricated to establish the level of impact energies which this system was capable of sustaining in the falling dart screening test. This would then serve as a goal for other materials systems to aim for if they were to equal or surpass the performances of the nylon 12 systems. After fabricating a series of nylon 12/253P rotating band specimens and subjecting them to falling dart screening tests, it was found that this system was capable of sustaining an impact energy of eight foot-pounds at all three test temperatures, -65°F, ambient, and 165°F, without visible damage other than the indentation from the blunted nose of the dart. Later in the program, in fact, it was learned that this level of performance was achieved by the nylon 12/253P system in an 0.200 inch band length as well as the 0.500 inch length. A set of Ll901-253P rotating band specimens was consequently sent to AFATL for gunfire testing. This set contained five specimens. All five were fired at ambient conditions and all five rotating bands were fully retained after leaving the test barrel. These bands had a 30° bevel on the front edge but none on the rear edge and since these were the locations of the observed imperfections, it is possible that with a more gradual bevel on the front and rear edges, the samples would have exhibited no imperfections at all. At any rate, the fact that all five samples passed was in accord with previous results and verified that our fabrication procedures were capable of producing rotating band specimens equivalent to those produced by other laboratories working in this area.

BMNO-253P

The close similarity of nylon 11 to nylon 12 (eleven carbon atom sequences in the chain backbone rather than twelve) made it an obvious choice to investigate since the nylon 12 had proved adequate. The fact that the nylon 11 source is located in France rather than the U.S.A. was a known drawback, but it was felt that if the material proved technically satisfactory, an alternate to the German-made nylon 12 would be a better situation than no alternate at all.

A series of BMNO/253P rotating band specimens were consequently prepared. Falling dart screening tests on this material system indicated that it was equivalent to the nylon 12/253P system at ambient and 165°F, but inferior at -65°F. At the low temperature the nylon ll system experienced both fracture and debonding from the projectile when impacted with eight foot-pounds. Because of the good performance at the two higher temperatures, a set of fifteen samples were sent to AFATL for gunfire testing. Five were to be fired at each of the three test temperatures. At ambient conditions, one photograph was not obtained when the camera malfunctioned. Of the remaining four, three passed the gunfire tests with no visible damage to the bands other than the engraving grooves, apparent in the photographs. The specimen which failed had lost the rear two-thirds portion of the band between two of the engraving grooves and a small piece from the rear of the adjacent between-groove section. All five specimens fired at 165°F were intact and therefore passed the test, although a very slight amount of fraying appeared to occur on the leading or trailing edges. All of the muzzle velocities of the 165°F shots were slightly lower than the 4000 fps target velocity (3946-3986 fps). This might be attributable to a softening of the material at this temperature with a subsequent failure to build up sufficient back pressure in the breech to impart a higher velocity for a given charge.

At -65°F, one specimen was not tested for unstated reasons. Of the remaining four, one specimen passed while three failed. Of the three failures, one sample had lost a small piece of the band from the front edge of the band while the other two lost half or more of their bands. Again, the above shots were conducted on samples which had a 30° bevel on the leading edge and none on the trailing edge and most all of the damage inflicted upon the bands was at one of these two locations.

BMNO-P3

In addition to the 253P adhesive used with the nylon 12 (L-1901) and nylon 11 (BMNO), an additional adhesive, sold by the same company that handles the BMNO resin, was tried. This adhesive, P3, was developed especially for use with nylon 11 and was tried, not only here, but also later with other types of nylon.

A relatively small series of BMNO/P3 specimens were prepared. In the falling dart screening test this system looked satisfactory at ambient conditions. A set of five samples were forwarded to AFATL for gunfire testing. Four of the five were fired with three of these four losing half or more of the band during firing, predominately from the rear edge of the bands. The fourth specimen might also have lost a part of the band but the in-flight photograph was difficult to interpret. These specimens also had a 30° bevel on their front edges and none on the rear.

Zytel 158-253P

The wide domestic availability and relatively low cost of type 6/12 nylon made this material a desirable candidate for evaluation. The molecular structure of nylon 6/12 would lead one to hope that its higher stiffness and melting point combined with its more frequent spacing of carbonyl groups would simultaneously serve to provide better 165°F performance than nylon 12 and also more sites for adhesive bonding to the projectile substrate.

Several sets of Zytel 158 rotating bands were prepared using 253P as the adhesive. It was reasoned that an adhesive which bonded to nylon 12

(which 253P does) should bond even better to nylon 6/12 because of the higher concentration of carbonyl sites. Several processing parameters, such as mold temperature and length of adhesive prebake time, were varied for these different sets of specimens. Unfortunately, the test results for the Zytel 158 material were not particularly good. Although some evidence of success was obtained, the Zytel 158/253P system by no means measured up to the performance of the nylon 12 system. It was found that the Zytel 158/253P system performed best when the 253P adhesive was not subjected to quite as long a prebake as with the nylon 12 system. The primary observable difference between these two conditions is the color of the 253P film at the end of the prebake period, being a light amber or honey color for the optimum Zytel 158 condition and a darker amber for the optimum nylon 12 condition. In the falling dart screening tests, the Zytel 158/253P system proved satisfactory at 72°F, but at -65°F its performance fell considerably short of that of the nylon 12 system. In order for the 6/12 material to survive a falling dart impact at ~65°F, the impact energy had to be reduced to four foot-pounds (the L1901/253P system survived an eight foot-pound impact). In gunfire tests, the Zytel 158/253P system, even at 72°F, fell considerably short of the nylon 12 performance. Samples from three different sets of Zytel 158/253P banded projectiles were fired at ambient conditions. All of the bands from two sets failed to perform satisfactorily. Of the three samples from the third set, one had clearly lost nearly the entire band, and while the photographs for the other two were too dark and blurred to interpret accurately, it appeared as though the bands on these two might have been substantially intact. All of the Zytel 158/253P samples which were gunfire tested had a 30° bevel on the leading edge and no bevel on the trailing edge. At any rate, of the total of six projectile samples fired from the three different sets, four were clear failures and two were questionable. This is in marked contrast to the near 100% success rate achieved by the nylon 12/253P system.

Zytel 158-P3

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This band material/adhesive combination employs an adhesive marketed for use with nylon ll but which, by the same reasoning stated in the previous section, was felt worth evaluating with the nylon 6/12 also. A total of four sets of samples were fabricated using this combination with about the same results as with the Zytel 158/253P system. The falling dart screening tests conducted at 72°F all resulted in satisfactory performance but at -65°F the result was uniformly poor with the band fracturing and debonding from the substrate projectile even at impact energies as low as four foot-pounds. In the gunfire tests at ambient conditions, a total of ten samples from three different sets were fired. Of these samples, only one was clearly intact after firing while two others might have been intact but blurred photographs made it difficult to tell for sure. Of the remaining seven, four were clear failures while the other three appeared to have lost portions of the band, but blurred photographs preclude an unequivocal statement to that effect. Just as with all the systems mentioned previously, the Zytel i58-P3 samples discussed here had a 30° bevel on the front edge of the band but a blunt rear edge.

Zytel 211-253P

Nylon 6 possesses a number of desirable features for consideration as a rotating band material. It is widely available domestically, it is relatively inexpensive and its chemical structure is very similar to that of nylon 12, the difference being that the repeating unit is half as long.

Four sets of Zytel 211-253P rotating band specimens were fabricated. Several processing parameters were varied during the fabrication of these specin.ens, including the temperatures at which the adhesive was baked prior to molding, the elapsed time between adhesive application and molding, and the temperature to which the projectile was induction heated subsequent to molding in order to consumate the bond. It was found that certain combinations of these processing variables produced rotating bands which performer

very well at ambient conditions and which also showed considerable promise at -c50F and 1c50F. The best results obtained during this program with the Zytel 211, 253P combination are briefly summarized in Table 3. It has been found that the projectile surface must be induction heated to about 500°F after molding to develop an adequate bond between the hylon band and the projectile. In fact, it has been found that repeating this induction heating process a second time improves the bond over just one heat-up. In each case, the sample was quenched in cold water immediately after induction heating to prevent warpage or distortion of the band. It has also been found that the degree of prebaking of the 253P adhesive can be a very significant factor in the ultimate performance of the rotating band. It was our experience that simply placing the adhesive coated samples in a circulating air oven set at 450° F for 45 minutes could not be depended on to yield reproducible results. This was apparent from the observable differences in adhesive color after ostensibly identical bakes. Inaccuracies in temperature control or temperature gradients within the oven are most likely responsible for this problem. It has been found that if the prebake is conducted as long as necessary to produce a shade of amber comparable to that in a beer bottle, without regard to the length of time required, the optimum prebake has been achieved. One other variable which was not optimized in this effort is mold temperature. All of the Zytel 211-253P samples were molded in a 230°F mold. Conceivably, use of a lower mold temperature could produce a more amorphous polymer structure and thereby increase the flexibility of the material and enhance its ability to perform satisfactorily at -65°F. In summary, as shown in Table 3, a very limited number of tests show that this material combination performs excellently at 72°F and shows sufficient promise at -65°F and 165°F to justify further work and process parameter studies. Contrary to the somewhat reduced muzzle velocities noted with the BMNO system at 165°F, the Zytel 211 results cited in Table 2 at 165°F all had muzzle velocities in the range 4026 to 4119 fps, which is almost identical to the 72°F muzzle velocity range and indicates that softening at 165°F occurs to a significantly lesser

or of the second of the contraction of the second of the s

TABLE 3
SUMMARY OF BEST TEST RESULTS FOR THE
ZYTEL 211/253P SYSTEM

	Test	Falling Dart	Gunfire Results
Specimen	Temperature	Result	(Bands had 15° bevel on leading edge
Number	(°F)	(8 ft lbs)	6° bevel on trailing edge)
	<u> </u>	(4 20 20 7	
90-09	75	Pass	
90-64	75		Pass
90-68	75		Pass
90-75	75		Pass
90-76	75		Pass
90-85	75		Pass
90-81	-65)	Piece fractured	
70-01	-65	and debonded	·
90-62	-65		Pass
90-66	-65		Pass
90-72	-65		Large piece off.
90-78	-65	-~-	Pass
90-83	-65		Photograph difficult to interpret.
,0-03	• • •		May be . very small piece off of
			leading edge.
90-63	165		Pass
90-67	165		Cannot interpret photo accurately.
90-74	165		May be slight fraying but photo
	1/5		blurred.
90-80	165		Pass
90-84	165		Photo blurred and hard to interpret
ļ			but a very small piece may be off
			of leading edge.

degree with the Zytel 211 than with the BMNO or nylon 12 material. All of the data in Table 3 are for samples with a 15° bevel on the leading edge and a 6° bevel on the trailing edge. A previous set of five Zytel 211-253P samples fired at 72°F with a 30° bevel on the leading edge and no bevel on the rear edge resulted in three clear successes and two which were difficult to interpret because of blurred photographs but which looked satisfactory for the most part with perhaps some slight fraying.

Zytel 211-P3

Three sets of Zytel 211-P3 samples were fabricated. Falling dart tests were conducted on samples from each of these sets and gunfire tests were conducted on samples from two of the sets. In each case, the falling dart impact test at 72°F resulted in neither fracture or debonding, while at -65°F both fracture and debonding occurred in the large majority of cases. One sample at -65°F did not fracture but it did experience some debonding. Of the two sets from which samples were gunfire tested, one was subjected to an adhesive prebake before molding of 450°F for 45 minutes while the other was prebaked for 10 minutes at 550°F. Tables 4 and 5 present the gunfire test results obtained for these two sets of samples. It is difficult to see a significant difference between the overall gunfire performance of the two different sets. Comparison of the data in these tables with that in Table 3 leads to the observation that there appears to be little to choose between the P3 or the 253P adhesive for Zytel 211 rotating bands. As with the Zytel 211-253P samples, all of the Zytel 211-P3 samples were molded with a mold temperature of 230°F and use of a lower mold temperature could help improve the flexibility of this material and improve its gunfire performance. It is also possible that further variation of the adhesive prebake condition could result in improved overall gunfire performance.

Zytel 211-P104

The same company which developed the P3 adhesive for use with nylon ll also offers a P104 adhesive which was developed for use with electrostatically

TABLE 4

GUNFIRE TEST RESULTS FOR ZYTEL 211/P3

PREBAKED A 1 450°F BEFORE MOLDING

	! Test	<u> </u>
Specimen	Temperature	
Number	(°F)	Gunfire Results
Number	(+)	Guinti e Results
01.17	7.5	
91-17	75	Pass
91-18	75	Pass
91-21	75	Pass
91-29	75	Pass
91-32	75	Pass
	l	
91-19	-65	Fail-Very small piece off
		rear edge.
91-26	-65	Fail-Piece off rear edge.
91 - 30	-65	Pass
91 - 33	-65	Fail-Piece off rear edge.
91-11	165	Pass
91-12	165	Fail-Piece off around rear edge.
91-16	165	Pass
91-25	165	Pass
91-35	165	Fail-Slight fraying at rear edge.
91-23	75	Fail-No pieces lost but some
		fraying.
91-27	75	Pass
91-28	75	Fail-No pieces lost but some
/		fraying.
91-34	75	Pass
/1-31		1 405

Note: First 14 specimens in table had 15° bevels on leading edge and 6° bevels on trailing edge. Last 4 specimens had no bevel on rear edge but had a 30° bevel on front edge.

TABLE 5

GUNFIRE TEST RESULTS FOR ZYTEL 211/P3
PREDAKED AT 550°F BEFORE MOLDING

	Test	
Specimen	Temperature	
Number	(°F)	Gunfire Results
91 -43	75	Fail-No piece lost but some
,	. 5	fraying.
91-44	75	Fail-No piece lost but some
71-11	• •	fraying.
91-52	75	Pass
91 - 53	75	Pass
91 - 57	75	Pass-May be very slight
71-31	,,,	fraying.
		Haying.
91-42	-65	Fail-Small piece off rear edge.
91-45	-65	Difficult to tell because of
71 -43	-03	blurring. May be small piece
		off rear edge.
91 - 46	-65	Pass
91 - 51	-65	Pass-Photo blurred.
91 - 58	-65	Pass-Photo blurred.
71-30	-03	rass-rhoto bluffed.
91 - 37	165	Pass-Photo blurred but may be
71-51	103	very small piece off
		rear edge.
91 - 39	165	Pass
91-40	165	Pass-Photo blurred but may be
71-40	103	very small piece off
		rear edge.
91 - 48	165	Pass
71-40	103	1 455
91 - 38	75	Fail-hard to tell for sure but
/. 55		may be very small piece
		off rear edge.
91 - 47	?5	Pass
91 - 54	75	Pass
91 - 56	75	Pass
<u> </u>	<u> </u>	

Note: First 14 specimens in table had 15° bevels on leading edge and 6° bevel on trailing edge. Last 4 specimens had no bevel on rear edge but had a 30° bevel on front edge.

applied coatings and for use in more severe environments. It was decided that the reputedly better invironmental resistance of this adhesive made it worth evaluating. Two sets of Zytel 211/P104 rotating band specimens were fabricated. One was molded with fresh adhesive and passed five out of five trials in 72°F gunfire tests (see Table 6). Samples from this set also looked good in the falling dart tests exhibiting neither fracture or debonding at 72°F or -65°F. The second set was molded six weeks later with the same batch of adhesive mixed earlier. in the falling dart test, samples from this set still underwent no fracture or debonding at 72°F. The initial 72°F gunfire results from this set of samples was quite poor, three failures in three trials. Beveled leading and trailing edges were then machined onto the remaining samples from this set and they were returned to AFATL for further gunfire testing. The beveled edge samples did very well in 72°F gunfire tests, passing all five trials but the performance dropped off at -65°F and 165°F. It is certainly not inconceivable that if this system were prepared with freshly mixed adherive and test fired with beveled edges, its performance might prove very good. Also, all of the Zytel 211-P104 specimens were prepared in a 230°F mold and use of a lower mold temperature could improve its flexibility and performance.

TABLE 6
GUNFIRE TEST RESULTS FOR ZYTEL 211/P104

	Test	
Specimen	Temperature	
Number	(°F)	Gunfire Results
92 - 11	75	Pass
92 - 14	75	Pass
92-18	75	Pass
92-19	75	Pass
92-20	75	Pass
92-21	75	Fail-Photo too dark to be sure but silhouette appears to indicate loss of a piece.
92 - 26	75	Fail-Photo too dark to be sure but looks like a small piece off front edge and some fraying at rear.
92-30	75	Fail-Photo blurred but looks like a piece is off.
92 - 2.5	75	Pass
92-29	75	Pass
92 - 35	75	Pass
92-39	7%	Pass
92-45	75	Pass
92-22	-65	Fail-Piece off.
92-27	-65	Fail-Almost entire band lost.
92 - 32	-65	Pass
92-37	-65	Fail-Piece off rear half.
92-47	-65	Pass
92-23	165	Fail-Photo too dark to be sure but piece looks off.
92-28	165	Fail-Photo blurred but looks like large piece off.
92 - 38	165	"Fail-Badly peeled.
92 - 43	165	Hard to tell-May be small
L	<u> </u>	piece off front edge.

Note: First 5 specimens made with freshly mixed adhesive and fired with 30° bevel on front edge but none on rear. Center three specimens made with adhesive mixed six weeks prior to use and fired with 30° bevel on front edge but none on rear. Last 14 specimens made with adhesive mixed six weeks prior to use but fired with 15° bevels on leading edge and 6° bevel on rear edge.

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III. CONCLUSIONS

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- 1. Although the data base from which the conclusions in this section are drawn is somewhat limited, it is felt that several material-adhesive combinations have clearly demonstrated sufficient potential to justify further and more in-depth evaluation as alternate material choices to nylon 12-253P for 20mm rotating bands.
- 2. The gunfire performance of the nylon 11 (BMNO)-253P system was only slightly below that of the nylon 12-253P system at 72°F. At 165°F, the nylon 11 system performed very well although at -65°F its performance was unsatisfactory. No attempts at processing optimization were undertaken in this program with the BMNO-253P system. This type of investigation combined with use of more gradual bevels on the leading and trailing edges of the rotating bands could substantially improve the performance of the BMNO system.
- 3. The nylon 6 (Zytel 211)-253P system, being one which is both domestically available and which has demonstrated the potential of performing well in gunfire tests at all three temperatures deserves further developmental and evaluation efforts. Its 72°F performance was excellent and its performance at -65°F and 165°F was good although photographic problems make it difficult to assess the results of all the test firings. Again no attempt at process optimization was made with this system.
- 4. The nylon 6 (Zytel 211)-P3 system has demonstrated considerable potential in gunfire tests and is worthy of further development and evaluation. The performance of this system at 72°F is excellent. At 165°F its performance is also very good. At -65°F it demonstrated considerable promise although its performance at this temperature was not as good as at 72°F or 165°F.

- 5. The nylon 6 (Zytel 211)-Pl04 system has also demonstrated considerable promise and should be further evaluated. Its gunfire performance at 72°F was excellent. At -65°F its performance was only marginal and at 165°F it did not perform well at all. It must be remembered that the performance at these latter two temperatures was determined from specimens made with an adhesive mixed six weeks prior to use and that process optimization efforts might achieve significantly improved gunfire performance.
- 6. Nylon 6, 12 (Zytel 158) was tried with four adhesives (P3, P104, 253P, and FM1000). At room temperature its gunfire performance was, at best, marginal. At -65°F the material did no; perform well at all.
- 7. Glass filled nylon 6 (Plaskon 8231 and Plaskon 8233) was tried at glass contents ranging from 30% down to 3 1/2% (Plaskon 8231 diluted with Zytel 211) with the P3, Pl04, and 253P adhesives. At the 3 1/2% glass content, this combination survived falling dart tests at 72°F and 165°F but exhibited fracture and debonding at -65°F. Since there is a possibility that the -65°F falling dart test is more severe than a -65°F gunfire test, further testing of this material should be undertaken, particularly gunfire testing.
- 8. Three different kinds of nylon 6, 6 were tried (Zytel 101, Zytel 42, Zytel 105) with four different adhesives (P3, P104, 253P, and FM1000). All performed poorly in the falling dart tests at room temperature, undergoing both fracture and debonding.

9. An ethylene-propylene terpolymer, designated Dexon, was tried without success. This material was reputed to bond well to steel without an adhesive and it was used in this program without an adhesive. It was found that the material simply did not bond very well to the projectiles and underwent substantial debonding in the falling dart test at room temperature.

- 10. A urethane band material (Texin 591A) was found to perform very well in room temperature falling dart tests but to fracture and debond in -65°F falling dart tests. The flexible nature of the material at room temperature makes its performance capabilities at 165°F in a gunfire test suspect, although no actual tests at 165°F have been conducted.
- ll. Phenylene oxide based material was tried in two forms, one a black, filled composition (SE100) and the other a gray, natural composition (ENG 265). A number of different adhesive/primer/processing parameter combinations were tried with results in falling dart tests at 72°F running from poor to marginal and results in dart tests at -65°F producing consistently fractured and debonded bands.
- 12. Two other materials were also tried, a thermoplastic polyester (Tenite 6T-91A) and an acryllic (ST-375) with very poor falling dart performance at 72°F being exhibited by both.

IV. RECOMMENDATIONS

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1. Process optimization studies should be performed on the BMNO-253P, Zytel 211-P3, and Zytel 211-P104 rotating band systems to improve the gunfire performance of these 20mm rotating band systems. Although it is felt that all aspects of the fabrication process are worthy of investigation, several which have been briefly touched on in this effort, will be especially mentioned because there is reason to believe that the performance of the system could be readily improved by suitable manipulation of these specific parameters. First, use of a mold temperature lower than 230°F should be investigated to determine if a more amorphous and thereby more flexible polymer structure could be obtained. Secondly, the degree of prebaking to which the 253P, P3, and P104 adhesives are subjected prior to molding should be varied. It has been found that this can be a very significant factor and that the degree of prebaking which is optimum can vary from one band material to another.

APPENDIX A

MATERIALS UTILIZED DURING 20mm ROTATING BAND INVESTIGATION

The information listed in tables A-1 through A-4 identify not only the band materials and band adhesives evaluated in this effort, but also indicates in what combinations the various band materials and adhesives were used.

Table A-1. Rotating Band Materials Investigated

Material Designation	Type of Polymer	Source
Dexon XPA-3	ethylene-propylene- acryllic acid terpolymer	Exxon Chemical Co. Baytown, Texas
Dexon XPA-4	ethylene-propylene- acryllic acid terpolymer	Exxon Chemical Co. Baytown, Texas
Tenite 6T91A	thermoplastic polyester	Eastman Chemical Kingsport, Tenn.
XT 375	acryllic	American Cyanamid Wayne, N.J.
Texin 591A	urethane	Mobay Chemical Co. Pittsburgh, Pa.
Noryl SE100	phenylene oxide- filled, black	General Electric Selkirk, N.Y.
Noryl EN265	phenylene oxide	General Electric Selkirk, N.Y.
Rilsan BMNO	Nylon 11	Rilsan Corp. Glenrock, N.J.
Zytel 42	Nylon 6/6 (hi-viscosity)	DuPont Wilmington, Del.
Zytel 101	Nylon 6/6	DuPont Wilmington, Del.
Zytel 105	Nylon 6/6 (filled, black)	DuPont Wilmington, Del.
Zytel 158	Nylon 6/12	DuPont Wilmington, Del.
Zytel 211	Nylon 6	DuPont Wilmington, Del.

Table A-1. Rotating Band Materials Investigated (concl.)

AMERICAN STREET, STREE

Material Designation	Type of Polymer	Source
Polyamide L1901	Nylon 12	Mobay Chemical Co. Pittsburgh, Pa.
Plaskon 8231	Nylon 6 (14% glass filled)	Allied Chemical Morristown, N.J.
Plaskon 8233	Nylon 6 (30% glass filled)	Allied Chemical Morristown, N.J.
Plaskc · 8231/ Zytel 211 [50:50]	Nylon 6 (7% glass filled)	*****
Plaskon 8231/ Zytel 211 [25:75]	Nylon 6 (3-1/2% glass filled)	
Plaskon 8231/ L1901 [25:75]	Nylon 6/Nylon 12 (3-1/2% glass filled)	*****

Table A-2. Adhesives Evaluated During Rotating
Band Investigations

Material Designation	Type of Adhesive	Source
253P	epoxy type	M&T Chemical Co. Cincinnati, Ohio
P3	epoxy-phenolic	Rilsan Corporation Glenrock, N.J.
P104	epoxy-phenolic	Rilsan Corporation Glenrock, N.J.
Loctite 307	urethane modified acryllic	Loctite Corporation Newington, Conn.
FM53	modified epoxy	Bloomingdale Div. of American Cyanamid Havre de Grace, Md.
FM238	nitrile phenolic	Bloomingdale Div. of American Cyanamid Havre de Grace, Md.
FM1000	nylon epoxy	Bloomingdale Div. of American Cyanamid Havre de Grace, Md.
Hysol 4405/ H8L 3538	niodified epoxy	Hysol New York, N.Y.
Scotchclad 776	oil resistant elastomer	3M Wayne, Mich.
Scotch.weld 2214	modified epoxy (filled)	3M Wayne, Mich.
Thixon AB 1153/66	rubber based adhesive	Dayton Chemical Prod. West Alexandria, Ohio

Table A-3. Adhesive Primers Utilized During Rotating Band Studies

Material Designation	Source	Recommended For Use With
BR-1009	Bloomingdale Div. of American Cyanamid Havre de Grace, Md.	FM1000
BR-238	Bloomingdale Div. of American Cyanamid Havre de Grace, Md.	FM238
BR-53	Bloomingdale Div. of American Cyanamid Havre de Grace, Md.	FM53
Locquik T	Loctite Corporation Newington, Conn.	Loctite 307

Table A-4. Rotating Band Material/Adhesive/Primer Combinations Investigated

Comb.	Band Material	Adhesive	Primer
1	Dexon XPA3	None	None
2	Dexon XPA4	None	None
3	Tenite 6T-91A	Loctite 307	Lockquik T
4	XT 375	FM1000	BR 1009
5	XT 375	FM238	BR 238
6	XT 375	Scotchclad 776	None
7	XT 375	Scotchweld 2214	None
8	XT 375	Thixon AB1153/66	None
9	Texin 591A	Thixon AB1153/66	None
10	Noryl SE100	FM1000	BR 1009
11	Noryl EN265	FM1000	BR 1009
12	Noryl EN265	FM1000	BR 53
13	Noryl EN265	FM53	None
14	Noryl EN265	FM53	BR 53
15	Noryl EN265	FM53	253P
16	Noryl EN265	Hysol 4405/ H8L3538	None
17	Rilsan BMNO	253P	None
18	Rilsan BMNO	P3	None
19	Polyamide L1901	253P	None
20	Zytel 42	253P	None
21	Zytel 42	P3	None
22	Zytel 42	P104	None
23	Zytel 42	FM1000	BR 1009
24	Zytel 101	FM1000	BR 1009
25	Zytel 101	253P	None /

Table A-4. Rotating Band Material/Adhesive/Primer Combinations Investigated (concl.)

Comb. No.	Band Material	Adhesive	Primer
26	Zytel 101	P3	None
27	Zytel 105	253P	None
28	Zytel 158	FM1000	BR 1009
29	Zytel 158	253P	None
30	Zytel 158	P3	None
31	Zytel 158	P104	 None
32	Zytel 211	253P	None
33	Zytel 211	P3	None
34	Zytel 211	P104	None
35	Zytel 211	FM238	BR 238
36	Zytel 211	FM1000	BR 1009
37	Zytel 211	FM53U	BR 53
38	Plaskon 8233	253P	None
39	Plaskon 8233	.P3	None
40	Plaskon 8233	P104	None
41	Plaskon 8231	253P	None
42	Plaskon 8231	P3	None
43	Plaskon 8231	P104	None
44	Plaskon 8231/ Zy tel 211 [50:50]	253P	None
45	Plaskon 8231/ Zytel 211 [50:50]	P3	None
46	Plaskon 8231/ Zytel 211 [25:75]	253P	None
47	Plaskon 8231/ Zytel 211 [25:75]	P3	None
48	Plaskon 8231/ Zytel 211 [25:75]	P104	None
49	Plaskon 8231/ L1901 [25:75]	253P	None

APPENDIX B

MOLDING PARAMETERS AND BONDING PROCEDURES USED TO FABRICATE PLASTIC ROTATING BANDS

Forty-nine combinations of band material/adhesive/primer were fabricated and evaluated during this program. Numerous processing variations were also superingosed upon these forty-nine combinations to yield a grand total of over one hundred material/processing combinations. Each of these combinations are described in this section and the specific processing conditions and molding parameters used for each combination are also listed. Recognizing that this is a cumbersome amount of information to present and that it is highly desirable to organize it such that the time required to comprehend it is minimized, the information has been divided into two sections. The first section presents the pertinent details needed to identify each material/adhesive combination and the surface preparation and adhesive application procedures used for that particular combination. It also refers the reader to the appropriate molding parameters utilized for that combination. The second section contains copies of the injection molding data records and indicates the temperatures, pressures, times, and machine settings used to injection mold each set of specimens discussed in this report.

Each table and record sheet contains identifying sample set and specimen numbers for cross referencing with the test data presented in Appendix C and Section IIE and also designates, by name and number, the band material. It should be kept in mind that during the early months of the investigations, because of a shortage of projectiles, some were used over a second time. This lead to the same sample number occasionally appearing twice in the accompanying tables, even though the band, adhesive, or processing conditions were different for the two different occasions.

	Remarks			Only one molded be- fore 3:0p-						·			
Sheet No. Pl	Post- Molding Treatment	None	None	None	Induction heated to en- hance bonding	None	None	Induction heated to en- hance bonding	None	None	Cure 1 hr. at 350°Fin		
Shee	Location of Molding Data	M	M	Z I	ĭ	ž	ž	Z Z	M I	7.72 M.2	M2		
	Adhesive Application Procedure	N.A.	i. N.A.	N.A.	. N.A.	N.A.	N.A.	N.A.	N.A.	brushed on, 16 hr. air dry, use within 24 hr.	film applied, 2 hr. air dry, use within 24 hr.		
	Primer Application Rroceduro	N.A.	N.A.	N.A.	N.A	N.A.	N.A.	N.A.	N.A.	sprayed on, excess wiped brushed on, 16 hr. off, 20 min, air dry, ro- air dry, use withir spray, 1 hr. air dry	brush on, apply adhesive while still tacky		
PARAMETER RECORD	Projectile: Surface Preparation	Glass bead blast and solvent cleaned	Glass bead blast and zolvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glass bend blast and solvent cleaned	Glass bead blast and solvent cleaned	Olass bead blast and solvent cleaned	•				
SING PARAM	Sample Numbers	None	50-1 to 50-6	None	Mixed	None	53-1 to 53-6	Mixed	53-11 to 53-25	6°-1 to 60-6			
PROCESSING	Primer	None	None	None	None	None	None	None	None	Locquik Primer T	38 1009		
BAND P	Adhesive	None	None	None	None	None	None	None	None	Joctite 307	5.X 1000		
ROTATING	Resin	Dexon XPA3	Dexon XPA3	Dexon X PA 3	Devon XPA3	Dexon XPA4	Dexon XPA4	Devon XPA4	Devon XPA4	Teaste 2	Nory1 SE100		
ROJ	Combination Number	-	2	٦	4	v	۰,	r	8	6	0 1		

	Remarks	Sample 6 -5 induction beated to										
Sheet No. Pt	Post- Molding Treatment	None	Induction heated	None	None	None	None'	Cure 45min. @ 2500F in	Cure 1 hr. (3500Fin steel sleeve	Cure 1 hr. @ 350°F in	None	
Shee	Location of Molding Data	M2	Μ2	M2	M2	Ņ2	M9	% ₩	M9	M9	8 X	·
	Adhesive Application Procedure	Dipped in undiluted 253P, shake off excess, air dry 1/2 hr,	baked 45 min. at 4500F. Achesive diluted 50% w. MEH	Brushed on. Air dry 1/2 - 1 hour.	Brushed on. Air dry 1/2 - 1 hour. Baked 50 min. @ 360°F.	Brushed on. Air dry 1/2 - 1 hour, Baked 50 min. @ 360°F;	Brushed on. Air dry 1/2 - 1 hour. Baked 50 min. @ 360º r.	Thin with MEK. Brush on worm. Dry I hour @ R. T.	Apply over tacky prinite. Air dry 2 hrs. Use within 24 hours.	Apply on tacky pr'mer. Dry overnight @ R.T.	Brush on. Dry overnight @ R. T.	
-	; ; ; Primer !Application Procedure	N.A.		N.A.	 N. A.	, N.A.	N.A.	N.A.	Brushed on. Adhesive applied while still tacky.	Brushed on. Air dried to tackiness.	N. A.	
METER RECORD		Glass bead blast and solvent cleaned	Glass bead blast and solvent steaned	Glass bead blast and solvent cleared	Glass bead blast and solvent cleaned	Glass bead bast and solvent cleaned	Glass bead blast and sølvent cleaned	Gloss bead blast and solvent clonned	Glass bead blast and volvent cleaned	Class bead blast and solvent cleaned	Glass bead blast and solvent cleaned	
SING PARAM		65-1 to 65-6	65-1 to 65-6 (reused)	10-1 to 10-10	10-11 to 10-15	10-16 to 10-20	34-1 to 31-10	33-1 tc 33-5	30-1 to 30-5	31-1 to 31-5	32-1 to 32-5	
PROCESSING	Primer	None	None	None	None	None	None	Neno	BR 1009	BR 238	None	
BAND P		2535	253P	Thixon AB1153	Thixon 1B1153	Thuxon AB1153	Fhtxon AB1153	Scotch. 2214	FN1 1000	FM 238	1cotch. 776	
ATING	Resin	Zytel 105	2yte! 105	Texin 591A	Texin 591A	Техіп 591A	XT 375	XT 375	XT 375	XT 37.5	XT 375	
3OT.	Combination Number	=	12	13	1.4	15	16	17	18	19	20	

	,							,				 -	
	Remarks												
Sheet No. P3	Post- Molding Treatment	None	Induction	Induction	Induction	Induction	Induction	Induction heated	None	Induction	Induction	Induction	
Shee	Location of Molding Data	М3	Χ 3	₹3	ž 3	ž	M3	M3	χ.	M4	M 4	Σ	
	Adhesive Application Procedure	Dipped in undeluced 253P. Shake off excess Air dry 1/2 hr.	same as above except 50% diluted with MEK and baked 45 min, at 450°F	same as comb. #22	same as comb. #22	same as comb. #22	Dipped in undiluted P3, thake off excess. Air dry 1/2 hr. Bake 10 min. at 55091	same as above except 50% deluted with MEK	same as comb. #21	same as comb. #21 ad- hesive was also baked 45 min, at 450°F	same as comb, 1122	same as comb. #22	
	Priner Application Procedure	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	
PARAMETER RECORD	11	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent clenned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent eleaned	
	Sample Numbers	80-1 to 80-6	80-1 to 80-6 (reused)	Mixed	80-11 to 80-25	80-26 to 80-35	82-1 to 82-6	82-1 to 82-6 (reused)	85-1 to 85-6	85-1 to 85-6 (reused)	85-1 to 85-6 (reused)	85-7 to 85-30	
PROCESSING	Primer	Z one	None	None	None	None	None	None	None	None	None	None	
BAND P	Adhesive	253P	2539	253P	253P	253P	P3	P3	253P	253P	253.5	253P	
ATING	Resin	Rilsan BMNO	R.1san BMINO	Milsan	usan Okuke	Rulsan BMNO	Nilsan BMINO	Relsan BM:NO	L1901	10617	10617	L1901	
ROT	Combination Number	2.1	22	23	24	2.5	26	27	23	62	30	31	

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	Remarks											
Sheet No. P4	Post- Molding Treatment	Cure FM1000 1 hr.@ 350 F in steel sleeve.	None	None	Induction	Ind action heated	Induction heated	Induction	Induction heated	Induction	Induction heated	
Shee	Location of Molding Data	N15	M5	MS	MS	N.55	MS	M5	M5	M6	M6	
	Adhestve Application Procedure	Apply over tacky prl- mer. Air dry 2 hr. Use within 24 hr.	same as comb. #21	same as comb. #29	same as comb. #22	same as comb. 422	same as comb. #22	same as comb. #22 except not used for 3 days	same as comb. #22	Axx adhesive, Let stand 24 hrs Use undiluted, Diptshake off excess, Air dry 10 min, Bake 15 min, at 450°F.	Mix adhesive, Let stand 24hrs Use undiluted, Dip & shake off evcess, Air dry 10 min, Bake 15 min, at 450 ⁶ E.	
	Primer Application Procedure	Brushed on. Adheslve applied while still tacky	N.A.	N.A.	N.A.	N.A.	N. A.	N.Ā.	. N.A.	N.A.	N.A.	
METER RECORD		Glass bead blast and solvent eleaned	Glass bead blast and solvent cleaned :	Glass bead blast and solvent eleaned	Glass bead blast and solvent cleaned	Glass bead blest and solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glaus bead blast and solvent cleaned	Glass bead blast and solvent cleaned	
PROCESS'NG PARAM	Sample Numbers	70-1 to 70-6	75-1 to 75-6	75-1 to 75-6 (reused)	75-1 to 75-6 (reused)	Mixed	75-11 to 75-15	75-16 to 75-35	75-36 to 75-45	77-1 to 77-10	77-1 to 77-10 (reused)	
ROCESS	Primer	BR 1009	None	None	None	None	None	None	None	None	None	
BAND P	1	FM 1000	2535	253P	253P	2535	253P	253P	253P	P104	P104	
ATING	Resin	Zytel 158	Zyte1 159	Zyte1 153	Zytel 153	Zytel 159	2) tel 153	Zyte1 158	2y:e1	Zytel 158	2ytel 158	
- [- [-	Combination Number	32	33	3,4	35	36	37	38	39	0,4	4 1	

以上,我们是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一个人,我们也是一

	Remarks										
Sheet No. P5	Post- Molding Treatment	Induction heated	Induction	Induction	Induction heated	Induction					
Shee	Location of Molding Data	M6	M6	M6	M6	9W					
	Adhesive Application Procedure	Same as comb. #26 except baken at 450°F instead of 550°F	Same as comb. #26	Same as comb. #26	Same as comb. #26 except not used for 3 days	Same as comb. #26					
	Prlmer Application Procedure	N.A.	N.A.	N.A.	N. A.	N.A.					
WETER RECORD	· Projectile Surface Preparation	Glass bead blast and solvent eleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned	Glaus bead blast and solvent cleaned			-		
ING PARAME	Sample Numbers	76-1 to 76-10	76-11 to 76-35	76-36 to 76-40	76-41 to 76-60	76-61 to 76-70				-	
PROCESSING	Primer	None	None	None	None	None					
BAND P	Adhesive	£	P3	£d	P3	ъз.					
ATING	Resin	Zytel 158	Zytel 158	Zytel 158	2) tel 158	2) tel 158					
ROT	Combination Number	4.2	4.3	**	4.5	46					

	Remarks												
Sheet No. 76	Post- Molding Treatment	Induction heated	Induction heated	Induction heated	Induction heated	Induction	Induction	Induction heated	Induction heated	Induction heated			
Shee	Location of Molding Data	M7	TM	M7	M7	LW7	7M	M7	1M	7 W			·
	. Adhesivo Application Procedure	Same as comb, #22, but not used for 5 days	Same as comb, #22	Same as comb. #22	Same as comb. #22 except baked 1 hour at 4500F	Same as comb. #26	Same as comb. #26	Same as comb. #26 except baked i min.	Same as comb. #52	Same as comb. #53	•		
	Primer 'Application Procedure	N.A.	. N.A.	. N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		-	•
PARAMETER RECORD	Projectile 'Surface Preparation	Glass bead blast and solvent cleaned	Glass bead blast and solvent cleaned;	Grit blast and solvent cleaned	Grit blast and i solvent cleaned	Glass bead blast and solvent cleaned	Glass bead blast, and solvent cleaned	Glass boad blast and solvent cleaned	Grit blast and solvent cleaned	Grit blast and solvent cleaned		•	
	Sample Numbers	67-1 to 67-24	67-25 to 67-44	67-45 to 67-49	67-50 to 67-54	68-1 to 68-10	68-11 to 68-15	68-16 to 68 20	68-21 to 68-25	68-26 to 68-29			
PROCESSING	Primer	None	None	None	None	None	None	None	None	None			
BAND P	Adhesive	253P	253P	253P	253P	73	P3	P3	P3	£4			
OTATING	Resin	2y:el 101	Zytel 101	Zytel 191	2ytel 101	Zytel 101	2ytel 101	2ytel 101	2ytel 101	Zytel 101			
207	Combination Number	47	48	49	80	15	52	53	54	55		·	

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	Remarks										
No. P7	Post- Molding R Treatment	Induction	Induction heated	Induction	Induction	Induction	Induction heated	Same as Comb. #10			
Sheet No.	Location of Molding Data	M8	M8	8 8	χ 8	×8	M8	M8			
	Adhesivo Application Procedure	Same as Comb. #26	Same as comb. #26 except baked 10 min. @ 5250Finstead of 5500F	Same as Comb. #40	Same as comb. #40 except baked 15 min. @ 475°F instead of 450°F.	Same as Comb. # 22	Same as comb. #22 except baked 45 min. @ 425°F instead of 450°F.	Same as Comb. #10			
	Primer Application Procedure	N.A.	N.A.	N.A.	N.A.	N.A.	N. A.	N. A.			
PROCESSING PARAMETER RECORD	Projectile Surfac Preparation	Glass bead blast and solvent eleaned.	Glass bend blast and solvent cleaned	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bend blast and solvent cleaned.			
ING PARA	Sample Numbers	41-1 to 41-10	41-11 to 41-15	42-1 to 42-10	42-11 to 42-15	40-1 to 40-10	40-11 to 40-15	43-1 to			
CESS	Primer	None	None	None	None	None	None	8.8 1009			
BAND P		£6.	<u>ب</u>	P104	P104	253P	253P	FM 1000			
ROTATING	Resin	Zytel 42	Zytel 42	2ytel 42	Zytel 42	Zytel 42	Zytel 42	Zytel 42			
ROL	Communation Hember	\$6	57	888	59	03	61	29			

	Remarks			٠	Some had berein machined on edge before Sunfire.			fome had berela inachined on edges before rundre.	•				
Sheet No. P8	Post- Molding Treatment	Induction heated	Induction heated	Induction hqated	Induction	Induction heated	Induction heated	Induction heated	Induction	Induction	. Induction heated	Induction heated	
Shee	Location of Molding Data	M10	M10	M10	M11	· M10	M10	M10	 M10	M10	MII	im	·
•	Adhesive Application . Procedure	Same as comb. # 22	Same as comb. #22	Same as comb. # 61 ·	Same as comb. # 22	Same as comb. #26 ex- cept baked 45 min. @ 450 °F instend of 10 min. @ 550°F;	Same as comb. # 67	Same as comb. # 26 except air dried 1 hr. instead of 1/2 hr.	Mix aabesive. Let stand 24 hrs. Use undiluted. Dip & rhake off excess. Air dry 10 inin.	Same as comb. 470 except also baked 15 min. 4500? before molding.	Same as comb. #71 ex- cept adhesive mixed 6 weeks prior to use.	Same as comb. #71	•
	Primer Application Proceduro	N.A.	N.A.	. N.A.	. N.A	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	. N.A.	
METER RECORD	rg v rd	Glass bead blast and solvent cleaned.	Glass bead blast and	Glass bead blast and solvent cleaned.	Glass bead blast and solvent eleaned.	Glass bead blast and solvent cleaned.	Glass, bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass ocad blast and solvent cleaned.	·
ESSING PARAMET		90-1 to, 90-10	90-11 to 90-35	90-36 to 90-60;	90-61 to 90-85	91-1 to 91-10	91-11 to 91-35	91-36 to 91-60	92-1 to 92-10	92-11 to 92-20	92-21 to 92-45	92-46 to 92-57	
PROCESS	Primer	Non-	None	None	None	Nong	None	No ne	None	None	None	Nona	
BAND P	l .	253P	253P	253 P	253P	P3	P3	P3	P104	P104	P104	P104	
BOTATING		Zytel 211	2yte1	Zytel 2:1	Zytel 211	Zytel 211	Zytel 211	Zytel	Zy:el 211	Zytel 211	Zytel 211	Zytel 211	
l C R	Combination Number	63	4,	59	99	67	83	69	20	Ľ	72	73	

	Remarks				Adhesive cured 5 days after mold-	Adhesive crred 2 days riter mold-	Adhessive cur id 1 day after mold-	Adiosive cured 2 days after mold- ing.			
Sheet No. P9	Post- Molding Treatment	Adhesive cured lhr. © 350°F in steel sleeve	Adhesive cured 1 hr. (c 350°F in	Adhesive cured hr. © 3500F in	Adheave cured i hr. (# 3500% in steel sleeve	Adnesive cured 1 hr. @ 350°F in steel sleeve	Adhesive cured hr. 6 3500 m steel aloesy	Adnesive cured 2 hr. @ 350°F in steel sleeve			
She	Location of Molding Data	เเพ	ии	MII	M7	M7	M7	7W			
	Adhesive Application Procedure	Adhesive film applied to tacky prinier. Allowed to dry overnight @ R. T.	Adhesive film applied totacky primer. Air dried 2 hours.	Adhesive film applied to dry primer.	Same as comb. #75	Same as comb, #75	Same as comb, #75	Same as comb. #75			
	Primer Application Procedure	Brushed on and allowed to air dry to tackiness.	Brushed on and allowed to air dry to tackiness.	Brushedon and allowed to air dry 1/2 hour.	Same as Comb.    75	Same as comb, #75	Same as comb. #75	Same as comb, #75			
METER RECORD	rg S	Grit blast and solvent cleaned.	Grit blast and solvent cleaned.	Grit blast and solvent eleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent c.eaned.	Glass bead blast and solvent eleaned.	Glass bead blast and solvent cleaned.			
PROCESSING PARAM	Sample Numbers	93-1 to 93-5	94-1 to 94-5	95-1 to 95-5	69-1 to 69-10	69-11 to 69-15	69-16 to 69-20	69-21 to 69-25			
ROCESS	Primer	BR 238	BR 1009	BR 53	BR 1009	BR 1009	BR 1009	BR 1009			
BAND PR	Adhesive	F.M 238	F14 1000	F).( 53U	F.M. 1000	FN:	FM 1000	FN 1C 00			
OTATING	Resin	Zytel 211	Zytel 211	Zytel 211	Zytel 101	Zytel 101	Zytel 101	Zytel 101			
ROT	Combination Number	7.4	7.5	76	7.7	78	7.9	80			

<u> </u>													
	Remarks	Cure pressur provided by shrink tape	Gure pressure provided by shrink tape	Guri pressure provided by edring lape	Cure pressure provided by shrink tape	Gure pressure provided by elected tere	Gure pressure provided by theins tipa	Gure preseuse promided by shelph tape	Gare pressure provided by everal fape	Cure presents provided by edetables	Cure pressure provided by shrick tope	Guer pressure provided by shelick tops	Cure pressure provided by shrink tape
Sheet No. P10	Post- Molding Treatment	Adh.aive cured 16 hr at 175º F	Adhesive cured 1-1/2 hr at 25002	Auhesive cured 16 hr at 1750£	Adhearve eurod 1-1/2 hr at 2500F	Adhesiva cured 16 hr at 1750f	Adhesive cured 1-1/2 h. at 250°F	Sarne as combination	Same ar combination No. 62	Same as combination No. 81	Same as combination No. 82	combination	saine ar combination No. 82
Shee	Location of Molding Data	M12	2118	M12	M12	2114	M12	2112	21W	M12	M12	M12	N12
	Adhesivo Application Proceduro	Adherive film applled over dry primer	Adhesive film appiled over dry primer	Adheaive film applied directly onto projectile surface.	Adhesive film applied directly onto projectile surface.	Saine as combination No. 81	Same as combination No. 81	Dissolve FMS3U (ilm in MEK. Brush on, Ali dry I hr, at R. T.	Dissolve Phisby film in MEK. Brush on, Air dry I hr. at R. T.	Dissolva F2453U film in MEK. Brush on, Air dry 1 hr. at R. T.	Dissolve FMS3U film in MEK. Brush on, Alr dry I hr. at R. T.	Discolva FNISSO film in IAFK. Brush on, Alr dry I hr. at R. T.	Diesolve PMS3U film in MEN. Brush on Air dry 1 hr. at R.T.
	Primer Application Procedure	Dipped in undiluted MEK. Chake off excess. Air dry 1/2 hr. Dake 45 min, at 450°1.	Dipped in undiduted MAJK. Shake off excess. Alr dry 1/2 hr. Bake 45 min. at 45092.	N.A.	N.A.	Brush on. Air dry 1/2 hr. at R. T.	Brush on. Air dry 1/2 hr: at R.T.	Same as combination No. 61	Same as combination No. 81	N.A.	N.A.	Same as combination No. 85	Same as combination No. 85
METER RECOND		Class bead blasted and solvent cleaned	Glass bead blasted and solvent eleaned	Glass bend blasted and solvent eleaned	Glass bead blasted and solvent eleaned	Glass bead blasted and solvent eleaned	Glass bead blasted and soivent cleaned	Glass bead blasted and solvent cleaned	Glass bead blasted and solvent elecated	Glass bead blasted and solvent cleaned	Glass bead blasted and solvent cleaned	Glass bead blasted and solvent eleaned	Glass bead blasted and solvent cleaned
SING PAKAME	i Mumoers	21-1 to 21-3	21-4 to 21-6	21-7 to 21-9	21-13 to 21-12	21-13 to 21-15	21-16 to 21-18	21-19 4 21-20	21-21 & 21-22	21-23 & 21-24	21-25 4 21-26	21-27 ts	21-29 tb 21-30
PROCESSING	Primer	253P	253P	Z O O	None	BR 53	BR 53	2532	253P	None	Nono	ва 53	BR 53
BAND P	1	.r.w 530	F.W 530	FM 53U	FM 53U	FM	F.M. 53U	FN.53 NEK	FMS3	FW53 MEK	FM53 MEK	FM53 MEK	FLAS3 NEK
TATING		Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl E::265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265
	Combination Number	8	82	83	84	8 5	9.8	67	88	89	06	9.1	2.5

	Remarks											`	
Sheet No. Pl.	Post- Molding Treatment	Cured 1-1/2 br at 256°F in ahrlah tape	Cured 1 1/2 hr at 250°P In thrust ape	Cured 1-1/2 hr at 25097 in ohend tape	Cured 1-1/2 he at 250°F in shrink tape	Cured 1-1/2 hr at 250°F in shrink tape	Cured 1-1/2 he at 250°P in obeink tapo	Cured 1-1/2 hr at 150°F in thrink tape	Cured 1-1/2 hr it 150 ⁹ F in obrink tope	Cured 1-1/2 hr at 150°F in thrink tape	Cured 1-1/2 hr at 150°F in obrink tape	Cured 1-1/2 hr at 150°F in shrink tape	
She	Location of Molding Data	M 12	M 13	M12	M12	M12	N112	M12	M12	M.12	M12	M12	
	Adhesive Application Procedure	Same as combination No. 83 but also pre- cured 6 hr. at 1750F	Same as combination No. 83 but also pre- ured 5 hr, at 17% P	Jame as combination No. 83 but also pre- cured 4 hr. at 1759F	Same as combination No. 83 but also pre- cured 3 hr. at 1750F	Same as combination 340, 83 but also pre- baked 2 hr. at 1750F	Same as combination No. 83 but also pre- baked 10 br. at 1750F	Farts ALB mixed. Brushed on, Air dried 30 min, at R.T. and 2 min, at 206°E.	Parts ALB mived. Brushed on, Air dried 45 min, at R.T. and 2 min, at 2009	Farte Alah muxed. Brushed on, Air dried 60 min, at R.T. and 2 min, at 20095.	Farts AkB masel, Brushed on, Air dried 75 min, at R.T. and 2 min, at 2000 F.	Parts Alb mixed. Brushed on, Alr dried 90 min, at R.T. and 2 min, et 2009;	
	Primer Application Proceduro	N.A.	N.A.	N.A.	.A.M	Ν.Α.	አ.አ.	, v.n.	N.A.	.N.A.	N.A.	N.A.	
METER RECORD	Projectilo Surface Preparation	Glans bead blasted and solvent cleaned	Glass bend blasted and solvent cleaned		Glass bead blasted and solvent cleaned	Glass bead blasted and solvent cleaned	Glass bend blasted and solvent cleaned	Glass bead blasted and solvent cleaned	Glass bead blasted and solvent cleaned	Glasy bend blasted and solvent cleaned	Glass bead blasted and solvent cleaned	Glass bead blasted and solvent cleaned	,
SING PARAM	Sample Numbers	21-31 & 21-32	21-33 &	21-35 & 21-36	21-37 & 21-38	21-39 & 21-40 ·	21-41 & 21-42	22-1 & 22-2	22-3 & 22-4	22-5 & 22-6	22-7 & 22-8	22-9 & 22-10	
PROCESSING	Primer	None	None	None	None	None	None	None	None	None	None.	None	
BAND P	Adhesive	FM 53U	FM	F.M.	F.W 53U	FM	F.M. 53U	liysol 4405	Hysol 4405	Hysol 4405	Hysol 4405	Hysol 4405	
ATING	Resin	Noryl EN265	Noryl F1:266	Noryl EN265	Noryl EN265	Noryl EN265	Noryl FN265		Noryl EN265	Noryl EN269	1:0ryl EN265	Noryl EN265	
ROT		93	94	9.5	96	7.6	86	66	100	101	102	103	

	Remarka												
Sheet No. P12	Post- Molding Treatment	Adhesivo cured 1 hr at 350ºF In steel sleeve	Adhesive cured 1 hr at 350°F in steel sireve	Adhesive cured 1 hr at 350°F in steel sleeve	Adhesive cured 1 hr et 350ºF In steel sleeve	Adhesive cured 1 hr at 350°F in steel sieevo	Ach ealvo cured M13 i hr at 350°F no atest aleeve	Adhesive cured I hr at 350°F in steel steeve	Cured 1-1/2 hr at 300°F'n steel aleevo	Cured 2 hr at 250°F in steel sleeve	Cured 1-1/2 hr at 300°F in	Cured 2 hr M13at 250°F in steel sleeve	
She	Location of Molding Data	M13	M13	M13	M13	M13	M13	M13	M13	M13	M13	M13	
	Adhesive Application Procedure	Apply onto dry primer.	Apply onto dry primer.	Apply onto dry primer.	Apply onto dry primer.	Apply onto dry primer.	Apply onto dry primer.	Same as combination No. 10	Same as combination No. 10	Same as combination No. 10	Same as combination No. 10	Same as combination No. 10	
-	. Primer Application .Procedure	Brush on. Air dry. 1/2 hr.	Brush on. Air dry 1/2 hr.	Brush on. Air dry 1/2 hr.	Brush on. Air dry 1/2 hr.	Brush on. Air dry 1/2 hr.	Brush on. Air dry 1/2 hr.	San e as combination No. 10	Same as combination No. 10	Same as combination No. 10	Brush on. Dry 1-1/2 hr at 175°F. No longer tacky.	Brush on. Dry 1-1/2 hr at 175 ^o F. No longer tacky.	
METER RECORD	Projectile Surface Preparation	Grit blast.	Grit blast. solvent clean.	Grit blast. solvent clean.	Solvent clean, Acid etch, Water rinse, Alcohol rinse, Dry,	Solvent clean. Acid etch. Water rinse. Alcohol rinse. Dry.	Solvent clean, Acid etch, Water rinse, Alcohof rinse, Dry,	Glass bead blasted. Solvent cleaned.	Glass bead blasted. Solvent cleaned.	Glass boad blasted, Solvent cleaned,	Glass bead blasted. Solvent cleaned.	Glass boad ble sted. Solvent cleaned.	-
PROCESSING PARAN	Sample Numbers	231 to	23-5 & 23-6	23-7 & 23-8	23-9 to 23-12	23-13 k 23-14	23-15 & 23-16	24-1 to 24-5 ·	21-6 2 24-7	24-9 & 24-9	24-10 to 24-12	2:-13 to 24-15	
ROCES	Primer	3R 53	BR 53	BR 53	BR 53	BR 53	BR 53	P.R. 1009	BR 1009	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	BR 1009	BR 1009	
	Adhesive	FM 1000	FN:	F.M 1000	F.W.	FM 1000	FM 1000	. LW	FM 1000	F14 1000	FM:	F.W. 1000	
OTATING BAND	Resin	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	Noryl EN265	
ROT	Combination Number	104	. 105	106	107	108	109	110	111	112	113	114	

	Remarks	14% ,1233	14% glase	14% glass	30% glass	30% glass	30% glass	7% glass	7% glass	31/2% glass			
Sheet No. P13	Post- Molding Treatment	Induction heated	Induction heated	Induction heated	Induction	Induction heated	Induction heated	Induction heated	Induction heated	Induction heated			
Shee	Location of Molding Data	M14	M14	M 14	M14	M14	M14	M15	M15	M15			
	Adhesive Application Procedure	Same as comb. #22	Same as comb. # 27	Same as comb. # 40 except baked 25 min. @ 450°F instead of 15 min.	Same as comb. # 22	Same as comb. #27	Same as comb. # 117	Same as comb. # 22	Same as comb. #22 except diluted to 25% in MEK instead of 50%.	Same as comb. #22			
	Primer Application Procedure	N. A).	N. A.	N.A.	N.A.	N. A.	N.A.	N.A.	N.A.	N.A.	•		-
PARAMETER RECORD	Projectile Surface Preparation	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Class bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	-	-	
ESSING PARA!	INdinocra	100-1 to .103-6	101-1 to 101-6	102-1 to 102-6	110-1 to 110-6	111-1 to 111-6	112-1 :0	120-1 to 120-5	120-6 to 120-10	130-1 to 130-5			
PROCESS	Primer	Nonc	None	None	None	None	None	None	None	None			
G GNAE	l .	253P	£4	P104	253 P	ű	P104	253P	253P	253P			
E ONLINE OF		Plaskon 8231	Plaskon 8231	Plaskon 8231	Flaskon 8233	Plaskon 8233	Plaskon 8233	2. 211	P. 8231 Z. 211	P. \$231 Z. 211			
0 0	Combination Number	115	116	11.7	118	119	120	121	122	123			

	Reinarks	7% glas .	7% glass	31/2% 81888	31/2% 81260	31/2% glass	31/2% glass	31/2% glass	31/2% 8128 0		
Sheet No. Pl4	Post- Molding Treatment	Induction heated	Induction heated	Induction heated	Induction heated	Induction heated	Induction heated	Induction heated	Induction heated		
Shee	Location of Molding Data	M15	M15	M15	MIS	M15	M15	M15	M15		
	Adhesive Application Procedure	Same as comb. #27	Same as comb, # 27 except diluted to 25% in MEK instead of 50%.	Same as comb. # 27	Same as comb. # 40	Same as comb. # 22	Same as comb. # 22	Same as comb. # 22	Same as comb. # 22		
	Primer Application Procedure	N.A.:	N.A.	N.A.	N.A.	N.A.	.N.A.	N.A.	. N.A.		
METER RECORD	Projectile Surface Preparation	Glass bead blast and's solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent cleaned.	Glass bead blast and solvent eleaned.	Glass bend blast and solvent cleaned.	Solvent cleaned only.	Glass bead blast and solvent cleaned.	Solvent cleaned only.		
ROTATING BAND PROCESSING PARAM	Sample Numbers	121-1 to 121-5	121-6 to 121-10	131-1 to 131-5	132-1 to 132-5	135-1 to 135-3	135-4 to 135-6	135-7 to 135-9	135-10 to 135-12		
ROCES	Primer	Nono	None	None	None	None	None	None	None		
BAND P	Adhesive	P3	દ્વ	P3	P104	253P	253P	.253P	253P		
ATING 1	Resin	P. 8231 2.211	P. 8231 Z. 211	P. 8231 2. 211	P. 8231 Z. 211	P. 8231 L1901	P. 8231	P. 8231	P. 8231		
ROI	Combination Number	124	125	126	127	128	129	130	131		]

4					7.21		,	<del>,</del>	<del></del>					_
	necz	1	Total		Setting (inch)	1-3/16	1-3/16	1-3/16	1-3/16	1-3/16	1-3/16	1-3/16	1-3/16	
	Check Engineer	Askins	Feed	Rate	Setting Screw color)	Circen 0	Greer	Green	Green 0	Green 0	Green	Green 0	G::een 0	
M.		œ.	u	oir (43	ſsu⊃ oni)	1/8	1/8	. 1/8	1/8	1/8	1/8	1/8	1/16	
Sheet No.	Safety	Ü.	e d c d	I	NG A	160	160	160	160	160	160	160	160	
She			Screw	a.	on X Settin	13-5.0	B-5.0							
			(300)		Ram Motio	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	
	M O	p.	Times(sec.	IJ	Overa	120	120	120	120	021	120	120	120	
	/Scr	Standard		,	Open	55	55	55	55	55	55	55	55	
5RS.	Barrel/Scrow	St	Cycle	_	Injec tion	16	16	16	16	16	16	16	91	
3V-75RS	¤ 		Press.(psi)		Buck	125	125	125	125	125	125	125	125	
rado			Pres	_	lnjec tion	500	200	500	500	500	500	500	500	
Eldo				)Id	Mov-	7.5	260 260	350	180 180	. 75	992	180	200	
oury	no	nd	(OF)	Mold	bexiT	7.5	260	350	180	75	260	180	200	
New	Description	ig Band			Rear	400	400	400	400	400	450	450	450	
SD-	ī	Rotating	Emperature	7	Fron	450	450	450	450	450	450	450	450	
000	Mold	ĸ	P m	อา	.zoN	175	175	175	473	479	479	175	475	1
H H	2		3.5	]G 11G1	000		2	m	7.7	7	r,	4	5	
DATA				Adhe-	sive	None	None	Nonc	None	None	None	Z . 3e	None	
MOLDING DATA RECORD - Newbury Eldorado	Operator	Pike		Resin		Dexon XPA-3	USWON XPA-3	Denon XPA-3	Dexon XPA-3	Jexon {PA-4	ļ .	Dexon XPA-4	Dexen XPA-4	
Z	Job Opo	D.		Molding	Date	3-4-74	3-22-74	5-29-74	7-2-74	3-4-74	3-22-74 XF2A-4	7-2-74	9-20-74	

1. Three unnumbered samples. Comments:

2. Sample Nos. 50-1 to 50-6. Projectiles preheated to 350°F before being placed in mold. 3. One sample molded. Resin stuck to mold passages at this temperature and prevented further molding.

4. Seven samples. Abnormal numbering due to reuse of projectiles. 5. Sample Nos. 53-1 to 53-6. Projectiles preheated to 350°F before being placed in mold. 6. Sample Nos. 53-11 to 53-25. Projectiles preheated to 500°F before being placed in mold.

		cer		Total	Feed	Setting (inch)	-3/16	-3/16	-3/16	-1/4	-1/16			old.
	63	Check Engineer	Askins	4	Rate .		Green 8	Green 8	Green 8	Greer	Sreen 7			ample Nos. 60-1 to 60-6. e Nos. 65-1 to 65-6. e Nos. 20-1 to 20-10. le Nos. 10-1 to 10-20. These twenty subdivided into Samples 10-1 to 10-10 molded with no adhesive preprebaked adhesive. Samples 10-11 to 10-15 were cold 16 to 10-20 were hot when placed in mold.
			ŭ		(цэ	1	1/8	1/8	1/8	91/9	1/16			it odivir odhes 10-15 old.
	Sheet No.	Safety	Ü,	şg.	N	ld ਬ	110	400	400	:	; ; ;			enty s vith no -11 to
_	She			Screw	និប qc	Kna Settir	B-7.5	B-0.0	B-0.0	B-6. C	B-6.0			ese tw Ided v les 10 placec
				Times(sec.)	ui ui	Ram Moti	2-3	2-3	2-3	2-4	2-3			60-6. 0. ?0. The !-10 mo Sampl
		wo.		imes	Ils	Over	120	120	120	120	120			· · · · · · · · · · · · · · · · · · ·
	•	1/Screw	Standard	Cycle T		Oper	55	55	55	55	55		•	Tos. 60-1 to 65-6. 20-1 to 20-10 10-1 to 10-20 25 10-1 to 10-20 35 10-1 to 10-20 ed adhesive. 0-20 were hot
	5RS	Barrel/	Star		-:	oojni noit	56	16	16	56	97			Nos. 65-1 20-1 10-1 cs 10 ted ac
	3V-75RS	<u>щ</u>		Press.(psi)	>	Bacl	75	125	125	125	125			Sample Nos. 65-ple Nos. 65-ple Nos. 20-ple Nos. 10-cple Nos. 10-cple Nos. 10-cple prebaked a prebaked a 10-16 to 10-20
	rado			Press	-:	oojal goid	700	650	650	700	009			· · · · · · · · · · · · · · · · · · ·
	Eldorado				Mold	Mov- able	95	160	290	180	130			at 180°F. Samp 220°F. Samp 220°F. Samp 220°F. Samp five and five. I to 10-20 had. Samples 10-
	Newbury	ion	pu	(OF)	Ž	Pixec	95	160	270	180	130			22 22 22 Eti
		Description	otating Band	urc	Ι.	Rea	475	540	540	200	440			Resin dried 1-1/2 hr. at 188 Resin dried 2 hr. at 2000F. Resin dried 2 hr. at 2200F. Resin dried 3 hr. at 220°F. three groups of ten, five an bake. Samples 10-11 to 10 when placed in mold. Samp
	អ ក ក	l	otatir	perature	jţ.	101 न	200	540	540	525	450			d 2 hr. at d 2 hr. at d 2 hr. at d 3 hr. at ps of ten, nples 10-13d in mold
	O E C O	Wold	R	13r m	,	zzoN	525	570	570	550	140			Resin dried Resin dried Resin dried Resin dried three group bake. Sami
	A R	_		<b>3</b> ¢		ເຕ _ອ ວ		2	2	<u>α</u> ω	ঝ	 		Resin Resin Resin three bake.
	DAT				Adhe-	Sive	L. 307	253P	253P	123 (100) 121 (100)	Thix.			
	MOLDING DATA RECO	Operator	Pike		Resin		Fenite 5T91-A	2ytel 105	2ytel 105	Nory1 SE100	Texin 591A			Comments: 1. 2. 3.
	Ž	Job Ope	D.		Molding	Date	3-6-74	3-6-74	5-31-74	11-8-74	1-8-75			Comn

A	MOLDING DATA RECOR	3 DAT	A R	ECO	Ð.	Newbury	oury	Eldo	Eldorado	3V-75RS	5RS				She	Sheet No.		M3	
, Job Operator	erator			Mold		Description	on			B	Barrel/	Screw	cw		<u> </u>	Safety	Check		Enginee-
Ď.	Pike			Rot	tating	g Band	70				Standard	ard			<del></del>	Ö.	ä	Askins	
	···		าน	dwa	perature	- !	(OE)		Pres	s.(psi)	Cycle		Times(	s(sec.)	Speed	300	u	F,ecd	"otal
Molding Date	Resin	Adne- sive	ommoJ Sode	olzzoN	Front	Rear	Sixed Solving Sixed	yov-	Injec- tion	Васк	-pelal tion	Open	IlsiovC	ni mas) noitol/	don M gairte	MqA	coideu) (inch)	Rate Serew Serew color)	Feed Setting (inch)
4-18-74	Rilsan BMNO	253P	-	570	540	540	160	150	650	125	16	55	120		B-0.0	400	1/16	Green 8	1-3/16
4-18-74	Rilsan Baino	P3	2	570	540	540	091	160	099	125	16	5 5	120	2-3	B-0.0	400	1/16	6	1-3/16
5-31-74	Ailsan Daino	P3	3	570	540	540	270	290	0.9	125	16	55	120	2-3	ภ-0. ต	067	1/16	Ġ_	1-3/16
5-31-74	Risan Brito	253P	ঝ	570	5.10	540	270	290	650	125	16	55	120	2-3	B-0.0	400	1/16	15_	1-3/16
6-17-74	Ailsan Baino	253P	r2	570	540	540	270	290	650	125	16	55	120	2-3	3.0.0	400	1/16	<u> </u>	
7-16-74	Rulsan Batao	253P	9	570	540	540	280	280	650	125	16	55	120	2-3	3-0.0	:	1/16	_ 5	1-3/16
8-14-74	Rilsan BMNO	253P	7	570	540	540	280	280	650	125	1,4	55	129	2-3	3-0.0		1/16	5_	1-3/16
Comn	Comments: 1. 2. 3. 4. 5.		sin c sin c sin c sin c ject	Resin dried Resin dried Resin dried Resin dried Resin dried	13 hr. 13 hr. 12 hr. 12 hr.	at at at	200° F 200° F 200° F 200° F 200° F		Sample Sample Sample Sample Twelve	Nos. 80- 8 Nos. 82- 8 Nos. 82- 8 Nos. 80- 8 Samples.	dete	to 80 to 82 to 82 to 80 to 80	80-6. 82-6. 82-6(reused). 80-6(reused). normal numbe	nsec	to 80-6. to 82-6. to 82-6(reused). to 80-6(reused). Abnormal numbering due to reuse	due t	to reu	se of	

Molding machine had broken

Sample Nos. 80-11 to 80-25. Sample Nos. 80-26 to 80-35.

Resin dried 2 hr. at  $200^{\circ}F$ . Resin dried 2 hr. at  $200^{\circ}F$ .

6.

poppett for this run.

	ĭ	1		C.S	9	10	9	9		T	1	·	
٠.	neer	ļ	Total	Feed Settin (inch	1-3/16	1-3/16	1-3/16	1-3/16					
な	Check Engineer	Askins	Feed	Rate Feed Setting Setting (screw (inch)	Creen 0	Green	Green	Green 0					
N:4		R. Aş		oidenO (dɔni)	1/8	1/8	1/8	1/8					
Sheet No.	Safety	D.	%g gg	мчя	160	160	160	160					· <del>(</del> e
She			Screw	Knob Setting	3-7.9	B-7.5	B-7.5	B-7.5		٠			85-6. 85-6(reused). 85-6(reused again). 85-30.
			Times(sec.)	Ram in Motion	2	2	2	2-3					85-6. 85-6(reused). 85-6(reused a 85-30.
	cw		imes	Overall	180	180	180	180					85-6. 85-6(r 85-6(x
	I/ Serew	Standard	Cycle T	Ореп	55	55	55	55					5 5 5 5
SRS	Barrel/	Star		-pəjal roit	92	92	98	97					885-1 85-1 85-1 85-1
3V-75RS	<u>н</u>	-	Press.(psi)	Васк	125	125;	125	125					Nos.
rado			Pres	-pojal noit	009	009	009	009					Sample Sample Sample Sample
Eldorado				Nov-	175	175	280	290			·		1
Newbury	ion	and	(OF)	Fixed Nov-	175	175	782	27.0					200°F. 200°F. 200°F. 200°F.
	Description	ing B	١ ١	Rear	175	475	475	475					hr. at hr. at hr. at hr. at
RD -		Rotating Band	perature	Juoid	500	500	500 !	500					0000
RECO	Mold		임	olzzoN	575	575	575	575					dried dried dried dried
pq.				Sanimo Spo Sode		2	3	4					Resin
DATA				Adhe. sive	253P	253P	253P	2532					ł
MOLDING		Pike		Resin	10617	L1901	L1901	10617	-				Comments: 1. 2. 3. 3. 4.
Ä	Job Ope	'n		Molding Date	3-5-74	4-25-74	5-30-74	7-15-74					Comn

	reer		Total	Feed	Setting (inch)	1-3/16	-3/16	-3/16	-3/16	-3/16	-3/16	-1/8		
M5	k Engineer	skins	Feed	Rate	Setting (Serew (color)	Creen 8	Green 8	Green	Green 8	Green	Green 8	Green 8		
	Check	. R. A	u	(պ:	fauΩ oπi)	1/8	1/8	1/8	1/8	1/8	1/8	1/16		of previous specimens. after application of 253P.
Sheet No.	Safety	Д	e d	V	14 ਸ	400	400	400	400	1	400	150		s spec
She			Screw	d 3	orX Settin	B-0.0	B-0.0	B-0.0	B-0.0	3-0.0	B-0.0	B-0.0	i	evlou , r appl
			Times(sec.)		Ram Motic	2-3	2-3	2-3	2-3	2-3	2-3	2-3		s of pr
	e w		ime	115	Over	120	120	120	120	120	120	120		eusc
	Screw	Standard		,	Open	55	55	2.5	55	55	55	55		to r
SRS	Barrel/	Star	Cycle	-	oə[n] noii	16	16	16	16	16	16	16		ration.
3V-75RS			(:sd):s	:	Back	125	125	125	125	125	125	125		ove operati
Eldorado			Pres	-	injec roit	650	650	650	650	059	650	650		200°F for all of above operations. 70-6. 75-6. 75-6(reused). 75-6(reused again). Numbering was abnormal due to reuse of prevlous of 75-15. of 75-45. First twenty molded three days after applicance day as 253P application.
Eldo				1d	Mov- able	160	160	160	290	290	160	160		sed; sed; ing Firs
ury	u o	Band	(OE)	Mold	pixig	160	160	160	270	270	160	160		200°E for all 70-6. 75-6. 75-6(reused), 75-6(reused a Numbering 75-15. 75-15.
Newbury	Description		- 1		Rest	540	540	540	540	540	540	540		27777
DRD -	d Des	Rotating	perature	1	Tron	540	540	540	540	540	540	540		n dried 3 hr. at 200°F for all Samples 70-1 to 70-6. Samples 75-1 to 75-6. Samples 75-1 to 75-6(reused) Samples 75-1 to 75-6(reused) Samples 75-1 to 75-6(reused) Samples 75-1 to 75-45. Samples 75-16 to 75-45. Last ten molded same day as
ECC	Mold		8		zzoN	570	570	270	570	570	570	570		n dried 3   Samples 7 Samples 7 Samples 7 Samples 7 Eleven sar Samples 7 Elaven sar Last ten m
AR	_		าน	ou 1	ເ <u>ເນ</u> ດປ ດວ	ات ات	-2		4	rv.	9	7		in dried 3 Samples Samples Samples Samples Samples Eleven sa Samples Last ten
DAT				Ache-	sive	F241000 BR1009	253P	25312	253P	253P	2531	253P		Resin dried 3  1. Samples  2. Samples  3. Samples  4. Samples  5. Eleven se  6. Samples  7. Samples  1. Last ten
MOLDING DATA RECC	Operator	Dike		Resin		Zytel 158	Zytel 158	Zytel 158	2)tel 158	Zytel 158	2ytel 158	Zytel 158		Comments: 5
2	Job Ope	D.		Molding	Date	3-6-74	3-6-74	4-18-74	5-31-74	6-17-74	-2-11-0	1-23-75		Comn

A	MOLDING DATA RECO	DAT.	ਤੁਖ ਨ	1001	)RD -	- Newbury Eldorado	ury	Eldo	rado	3V-75RS	5RS	• ,			She	Sheet No.	•	M6	
, Job Operator	rator		2	told	Desc	Mold Description	no			E P	Barrel/Screw	/Scr	ew			Safety	7 Check	k Engineer	neer
Ď.	Pike			R	otatir	Rotating Band	nd				Stan	Standard				Н	D. R.	Askins	
			311	Sp.m.E	perature	- 1	(OF)		Pres	Press.(psi)	Cycle		imes	Times(sec.)	Screw	1	,	Feed	70,0
Molding	Resin	Adhe-	qe ue:	9I	3		Mold	51d	•				III		g q	,	юі 101	Rate	1 0 cg 1
Date		sive	າຫາວປ ເວັ	zzoN	Fron	Rear	Біхес	Mov-	Injec- tion	Васк	oojal roit	uodO	Overa	msA Motio	Knol Setting	ивы	deuD ani)	Setting Setting Screw (inch)	Setting (inch)
8-21-74	Zytel 158	P3	-	37C	540	540	087	280	650	125	16	55	120		3-0.0	:	1/8	Creen 8	1-3/16
9-6-74	Zytel 158	P104	2	570	540	540	280	280	650	125	15	55	120	2-3	3-0.0		1/8	Green. 8	1-3/16
9-6-74	Zytei 158	P3	3.5	57C	540	540	280	280	650	125	16	55	120	2-3	B-0.0	-	1/8	Green 8	1-3/16
10-11-7	Zytel 153	P3	4	570	5:10	540	160	160	650	125	16	55	120	2-3	3-0.0	1	1/8	Green 3	1-3/16
10-31-7-	Zytel 158	P104	10	570	540	540	160	160	650	125	16	55	120	2-3	B-0.0	-	1/8	Green 8	1-3/16
1-23-75	Zytel 158	P3	9	570	540	540	160	160	650	125	16	55	120	2-3	B-0.0	150	1/8	Green 8	1-3/16
									·										
Comments:		Resiveried I. Samples	hied	3 h s 76	indried 3 hr. at 200° Samples 76-1 to 76-	200°F for 76-10.	)F fo:	r all	of above	ove op	operations	.ns.							

Samples 77-1 to 77-10. Adhesive was mixed 6 weeks prior to use.

Samples 76-11 to 76-35.

Samples 76-36 to 76-40.

Samples 77-1 to 77-10(reused). Freshly mixed adhesive.

Samples 76-41 to 76-70. First twenty molded three days after application of P3., Last ten molded same day as P3 application. 7 w 4 w °

	MOLDING DATA	5 DAT	ARE	000	RECORD	Newbury		Eldorado	rado	3V-75RS	SRS				She	Sheet No.		M7	
, Job Operator	erator			Mold	Desc	Description	on no			m —	Barrel/	Screw	& ≪			Safety		Check Engineer	neer
D.	Pike				Rotating		Band				Standard	ard				Ω	я.	Askins	1
			<b>3</b> t	E A	Emperature		(OE)		Press	s.(psi)	Cycle		Times(	s(soc.)	Screw	e ≪	u	Feed	Total
Molding Date	Resin	Adhe- sive	ommo) Sode	olzzoN	front	Rear	Mold Poxi	10 -vo \ 10 -vo \ 10 -vo \	-pejni Lion	Back	-psirl roit	nogO	Overall	ni ms? noitoN	Knob etting	ВЪМ	oidenO (inch)	Rate Feed Setting Settin Screw (inch)	Feed Setting (inch)
3-8-74	Zytel 101	253P	-	- 00	009	009	230	230	500	125	16	55	0	2-3	B-0.0	:	1/8	üreen 2	1-1/4
8-13-74	Zytel 101	253P	2	00 %	580	009	230	230	500	125	16	55	120	2-3	B-0.0	;	1/8	Green 2	1-1/4
8-21-74	Zytel 101	P3	m	005	580	009	230	230	.500	125	16	55	120	2-3	3-0.0	1 1	1/8	Green 2	1-1/4
9-23-74	Zytel 101	253P	ぜ	000	009	009	160 160	091	,500	125	16	55	120	2-3	B-0.0	1	1/8	Green 2	1-1/4
9-24-74	Zytel 101	P3	'n	005	009	009	160 160	160	,500	125	16	55	120	2-3	B-0.0	1	1/8	Green 2	1-1/4
10-2-74	2ytel 101	FM1000 BR1099	9	000	009	009	160 160	091	500	125	16	55	120	2-3	B-0. d	-	1/8	Green 2	1-1/8
Comi.	Comments:	All ress 11. Rus 2. San 3. San 44. San 5. San 5. San 6.	resin drie Run term Samples broken po Samples Samples Samples preparati Samples	ried ried iss 6 pol iss 6 iss	resin dried 2 hr. Run terminated Samples 67-1 to broken poppett. Samples 68-1 to Samples 67-25 t Samples 68-11 t preparation and Samples 69-1 to	esin dried 2 hr. at 2000F Run terminated prematur Samples 67-1 to 67-24. A Broken poppett. Samples 68-1 to 68-10. B Samples 68-1 to 68-10. B Samples 68-1 to 68-29. Preparation and adhesive Samples 69-1 to 69-25.	at 200° E remature 67-24. A 68-10. E 68-29. adhesive 69-25. 7	F in a rely c Adhe Brok Brok Thes	in above operating due to barrely due to barrely dhesive applied roken poppett of These samples cure cycle studiffese samples s	esin dried 2 hr. at 2000 F in above operations. Run terminated prematurely due to barrel malfuncti Samples 67-1 to 67-24. Adhesive applied five days broken poppett. Samples 68-1 to 68-10. Broken poppett on machine Samples 67-25 to 67-44. Samples 68-11 to 68-29. These samples subdivided preparation and adhesive cure cycle studies. Samples 69-1 to 69-25. These samples subdivided cure cycles.	ions. I malfunction. five days pri n machine. subdivided int	uncti days thine.	on. prio:	on. prior to m into four nto four g	ions. malfunction. five days prior to molding. n machine. subdivided into four groups es. ubdivided into four groups	ng. M	nolding. Machine had groups for various sugroups for study of vari		ad surface /arious

4	MOLDING DATA	3 DATA		RECORD	1	Newbury		Eldorado	rado	3V-75RS	SRS				She	Sheet No.		M8	
Job Ope	Operator		2	Mold		Description	no			B	Barrel/	/Screw	ew		-	Safety	Check		Engineer
D.	Pike			Ro	statin	tating Band	ıq				Standard	lard				ņ	ŭ	Askins	
				dmag	ocrature	1	(OF)		Prese	36. (psi)	Cycle	1 1	Times(	s(sec.)	Screw	od od	l L	Feed	Total
Molding Date	Resin	Adhe- sive	Sonnne Sode	olzsoN	Front	Rear	Fixed Mov-	3016	-pojal noid	Язьध	-əəinl noit	пэфО	Overall	Ram in Motion	don M gaiddo	мач	oidauD (finch)	Rate Settin Seren	Rate Feed Setting Setting Sorew (inch)
9-10-74	Zytel 42	P104	-	590	540	580	230 230	230	700	125	16	55.	120		B-0.0	:	1/8	Green 6	1-1/4
9-10-74	Zytel 42	253P	<i>~</i> 3	590	540	580	230 230	230	200	125	16	55	120	4	B-0.0	:	1/8	Green 6	
9-10-74	Zytel 42	P3	m	290	540	580	230	230	700	125	16	55	120	4	B-0.0	:	1/8	Green 6	1-1/4
10-10-7	Zytel 42	P104	ব্য	590	540	580	230 230	230	700	125	16	55	120	*4'	B-0.0	:	1/8	Green 6	1-1/4
10-10-7	Zytel 42	253P	ທ	590	540	580	230	230	700	125	16	55	120	4	B-0.0	;	1/8	Green 6	1-1/4
10-10-7-	2ytel 42	P3	9	390	540	580	230	230	200	125	16	55	120	4	B-0.0	:	1/8	Green	1-1/4
10-10-7	Zytel 42	17X10CC (3)R 1009	2	590	540	580	230 230	230	200	125	16	55	120	4	B-0.0		1/8	Grean 6	1-1/4
CO E O	Comments: A	All residents of the state of t	resin dried Samples 46 Samples 46 Samples 46 Samples 46 Samples 46 Samples 46	ied s 42 s 42 s 440 s 440 s 440 s 440 s 443 s 443	3 hr -1 t -1 t -1 1 -1 1	at 42-40-40-420-420-420-420-420-420-420-420		in a la Adhes	175°F in above operations 10. Adhesive mixed two weeks prior to use. 10. 10. 1-15. Adhesive mixed two weeks prior to use. 15. 15.	perati ixed t nixed	wo we two w	seks /eeks	prior	to u	use.				

	MOLDING DATA RECO	G DAT.	K R	000	an Ga	- Newbury Eldorado	ury	Eldo.	rado	3V-75RS	sas.	{			She	Sheet No.			
Job OF	Operator			Mold		Description	u u			<u>ф</u>	Barrel/	/ Screw	۵\ر ₂		-	Safety		Chock Engineer	neer
	D. Pike			Ro	stating	tating Band	ere!				Standard	lard			!	Ü,	R. A	Askins	
			31	य स	perature		(OE)		Press	Press.(psi)	Cycle		mes(	Times(sec.)	Speed	Ş¢.		Feed	Total
Molding	Resin	Adhe-	16 1161		3		Mold	ıd	_	;	-	7	וןי			¥	(ųa	Rate	Feed
Date		sive	moJ oo	nzoM	norA	159A	Fixed	-voM. 91ds	lnjec roit	Back	Lnjec roit	Open	Over	Ram Motic	onM Settin	ИЪИ	feuD ari)	Setting Screw color)	Screw Screw (color) (inch)
11-18-74XT	XT-375	Thux.		525	475	375	130	130	700	125	16	55	120	2	B-7. d		1/8	Green 1	1-1/4
11-20-7-XT	XT-375	)cct. 2214	2	325	475	375	130	130	700	125	16	55	120	2	B-7.0	1 1	1/8	Green 1	1-1/4
11-20-7	-74 XT-375	000 (MG)	<u>m</u>	52.5	475	375	130	130	200	125	16	55	120	2	B-7. C		1/8	Green 1	1-1/4
11-20-74	XT-375	57.734	্য ক	525	475	375	130	i 30	200	125	16	55	120	2	B-7.0		1/8	Green 1	1-1/4
11-20-7	-20-7-XT-375	Scot. 776	ທ	525	475	375	130	130	200	125	16	55	120	ניז	შ-7. 0	I i	1/8	Green 1	1-1/4
															•				
				ļ															
															-		ļ.		
ů Ç	Comments:	All res 1. Sa 2. Sa 3. Sa 4. Sa 5. Sa	resin drie Samples Samples Samples Samples	1 2000000	3-1 to 0-1 to 1-1 to 2-1 to 3-1 to 3-	m m m m m	800	F in	above sive a	at 180°F in above operations. 4-10. Adhesive applied five days prior to molding. 3-5. 0-5. 1-5.	tions.	lays	prio	t o n	noldin	<b>.</b> bù			

The state of the s

	1000		į	1.0		(:::ci	7	1-1/4	1-1/6			7	1-1/4	1-1/4	oken ken sive
MIG	Check Engineer	: a (1.1% √		17:00	Rat v Settin Serev	color (ir cen	2 2	د.	2 2 2 2 2	Ciroci.	3	9 11.	~	ireei 2	Machine had broken Machine had broken for study of adhesive
				u	(1,5111) (1,5111)	5	9/1	1/8	1/8	6/ -	0/1	2/1	1/3	1/8	lochine chine h
Sheet No.	Safety	ָ ב	- 1	<del>ر</del> د د د د	Was			:	1				1 1	:	Z Q
Sh	-		L	Speed	donM gaidt	PS .	0-5	3-0.0	: - 0.0	0 - 41		0-0-	1-0.0	13-0.(	or to molding ore molding. groups of ten 91-60.
			i	• :	ni ms cotion	티.	?-!	2-3	2-3	~		?	2-3	2-3	to m c mol oups
	Screw	•		Lines(sec	verall	0	091	120	120	120	120	237	120	120	week prior to m poppett.  oppett.  onth before mo into two groups
	<b>I</b> ~	Standard		Cycle	uəd(	<del> </del>		55	5.5	5.5	7. 7.		55	55	 veek oppetionth
3V-75RS	Barrel/	Stan	-		-29[n 1]ec- 1101	I :		2	16	16	2		16	16	perations, lied one valued one pobroken pobroken poblivided i bdivided i
37-	F		0 /	reag. (bas)	પ્રુટ્ટ		271	125	125	125	125	1	125	125	opera opera ad brod d brolixed c ixed c iubdiv
Eldorado			ρ	27.7	-əəin noi	I C		550	550	550	550		550	550	d 2 hrs. at 2000F in above operations.  90-1 to 90-10. Adhesive applied one week prior to molding.  90-11 to 90-35. Machine had broken poppett.  91-1 to 91-10. Machine had broken poppett.  The twenty samples were subdivided into two groups of ten to variations.  90-36 to 90-60.  7. Samples 91-36 to 91-60.
				1000	5 -vol	2 2 2		230	230	230	230		230	230	 Tin signatures Machighes dhes
Newbury	ion	<del>در</del> ا	(r. 0)		ixec	230		230	230	230	230		230	230	10
- Now	crip	tating Band	11170		Ксат	200		200	500	200	500		200	500	2 hrs. at 200 -1 to 90-10. -11 to 90-35. -1 tr, 72-20. he twen'y sam variations. -36 to 90-60. -11 to 91-35.
1	d Description	tating	Bmperature		Juorg	٦ ١	,	200	500	500	500		200	500	ed 2 hrs. at 20 90-1 to 90-10. 90-11 to 90-35 91-1 tc 91-10. 92-1 tr 72-20. The twei'y sa on variatic 1s. 90-36 to 90-60 91-11 to 91-35
RECCRD	Mol	Ro			Mozzle SizzoV				200	300	300	1 3	5	300	1 0
A F	_		<u> </u>		mino Soo		<del></del>	<u> </u>	m	77	'n	L	ه	7	resin dri Samples poppett. Samples Samples poppett. applicati Samples
3 DAS				Adher	sive	253P	1	1502	P3	P10.4	2532	į	2	D3	<u>-</u> :
MOLDING DATA	orator	Pike		Zesin	<del></del>	Zytel 211	Zytel	Zytel	211	211	Zytel 211	Zytel	Zvtel	211	
	, Job Operator	ام		Molding	Date	7-30-74	7-30-74		8-21-74	8-29-74	9-4-74	9-4-74		9-5-74	Comments:

<u></u>	Z	MOLDING DATA	DATE	1 RE	RECOR	D.	Newbury	1	Eldorado	rado	3V-75RS	RS.				She	Sheet No.		MII	
1	Job Ope	Operator			Mold		Description	no			E C	Barrel/	Screw,	1		-	Safety	Chec	Safety Check Engineer	בסם::
	Ď.	Pike				Rotating	ng B	Band				Stan	Standard				Ö.	R. As	Askins	
				วุน		emperature	í	(OF)		Press	9.(psi)	Cycle		mes(	Times(sec.)	Speed	300	u	Food	7059
Σ"	Molding Date	Resin	Adhe-	Comme	Mozzle	Front	Веаг	Soxiq Sov-Volv.	able	-poinl noid	Back	-poini roit	nogO	MeravO	ni mss notioM	don X Saiting	Män	roiriauO (rinch)	Rate Serving colony	Food Setting (inch)
10	10-16-7-	Zytel 211	P104		300	200	500	230	230	550	125	16	55	120	~	13-0.0	:	1/8	ircen 2	1-1/4
2	10-17-74	Zytel 211	253P	رم	000	500	500	230	230	550	125	16	55	120	2-3	13-0.0	1	1/8	S 8	1-1/4
-2	2-7-75	Zytel 211	P104	3	500	500	500	230 2	230	550	125	91	3.5	. 20	2-3	3.0.0	120	1/8	Green 3	1-1/4
62	4-8-75	Zytel 211	FN1238 BR234	7,7	500	500	525	160	160	550	125	16		j	1	3-2.0	•	1	Green 3	·!
-4	-8-75	Zytel 211	F 2 (1 000)	5	200	500	525	160	160	550	125	16		120	۳	13-2. C		1	ircen	! ~
-;:	-8-75	Zytel 211	ENE30 5853	9	200	200	525	1 60 1	(	550	125	16	1	<del></del>	3	10	120	1/8	Ureen 3	1-1/8
											-						1			
	Comments:		All resin dried	in d	ried	2 hr.		1000	for	these	at 200 ^o F for these operations.	lons.	İ	•						
			1. Sar 2. Sar	Samples Samples	es 92-	12	to 92-	92-45.	Adh	esive r	Adhesive mixed six weeks prior to use.	o ix we	·	prio	יי to	18 G.				
		<b>4</b>	.•	Samples Samples Samples	28 93- 28 94-	3-1 to 1-1 to 1-1 to	93-54	· •												
		-		Samples	36 ss	5-1 to	95-5	•												
									•											
-							-				-	-								

A CONTROL OF THE SECOND OF THE

-	MOLDING DATA RECORD	DAT.	A R	EC0	RD -	Newbury	bury	Eldo	Eldorado	3V-75RS	388				Sheet	ot No.		M12	
, Job Op	perator		-	· ·Mold· Do	i. Des	scription	ion			m -	Barrel/Screw	Ser	cw		-	Safety		Check Ingines	2000
D.	Pike			•	Rotati	ting B	Band				Standard	rd				ລີ	ä	Askins	:
			20		Emperat	ature	(OF)		Pres	Press.(psi)	Cycle	) ;	Times(sc	(300)	Space	30	u	200g	Terof
Molding	Resin	Adher			3		ž	Mold	-		_	,	111	uı		y		2010	· (
Date		sive	:moJ :00	zzoN	Fron	Fear	poxiq	Sole Nov-	oojal noid	Back	oojal noit	nog O	STOVO	Ram	onX Settin	<b>ਪ</b> ਰ ਸ਼	fauD ani)	30702	(inch)
3-18-75	Noryl EN265	9685 9685		550	525	500	200	200	700	125	92	5.5	120	2-4	3-6.0	09	1/8	().een	1-1/8
3-18-75		F3:453U	2	550	525	200	200	200	700	125	56	5.5	120	2-4	3-6.0	09	1/8	7.1 ce::	
3-18-75	No:91 1.N265	EN510 8453	٣	550	525	500	200	200	7.30	125	97	55	120	2-4	3-6.0	09	1/8	Green	3/1-1
3-19-7:	Noryl FN265	llysol -1405	*	575	909	009	200	200	700	125	2.6	5.5	120	2-4	3-6.0	0.9	1/8	Creco 4	
3-20-75		FN153 253P	ហ	575	009	009	200	200	700	125	97	5.5	120	2-4	3-6.0	09	1/8	5	1-3/8
3-20-75	Noryl FN265	rm53	9	575	009	009	002	200	700	125	92	5.5	120	2-4	11-6.0	09	1/8	(); () () ()	1-3/8
3-20-75	Noryl EN265	F N153	7	575	009	009	200	200	700	125	26	55	120	2-4	3-6.0	09	1/8	Cree.	
3-28-7	Noryl EN265	FAISJU	8	909	009	500	220	220	700	175	16	5.5	120	2-3	3-6.0	65	1/16	Green	1-1/4
Com	Comments: 1 3 3 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Resun dried 2 hr. at 220°F for 1. Samples 21-1 to 21-6. 2531 primer for the FM53U adhes 2. Samples 21-7 to 21-12. Thu 3. Samples 21-13 to 21-18. The between adhesive application 5. Samples 21-19 to 21-22. 25 of two different cure schedu 6. Samples 21-23 to 21-26. No 7. Samples 21-27 to 21-30. Bl 8. Samples 21-31 to 21-42. No various adhesive precurs sc	ied 2  es 2  es 2  es 2  en ac  es 2  duff  es 2  duff  es 2  es 2  es 2  es 2  es 2	hr. 11 to 11 to 12 to 12 to 13 to 14 to 15	Samples 21-1 to 21-6. Samples 21-1 to 21-6. Primer for the FM53U ac Samples 21-7 to 21-12. Samples 21-13 to 21-18. Samples 22-1 to 22-10. between adhesive applica Samples 21-19 to 21-22. of two different cure sch Samples 21-23 to 21-26. Samples 21-27 to 21-30. Samples 21-27 to 21-30.	samples 21-1 to 21-6. 253P adhesive was primer for the FM53U adhesive film. Samples 21-7 to 21-12. The FM53U film. Samples 21-7 to 21-12. The FM53U film. Samples 21-13 to 21-18. The recommend Samples 22-1 to 22-10. These ten were sbetween adhesive application and molding. Samples 21-19 to 21-22. 253P primer as of two different cure schedules.  Samples 21-23 to 21-26. No primer used. Samples 21-27 to 21-30. BR53 primer. 6 Samples 21-31 to 21-42. No primer used.	or all of above op 3P adhesive was nesive film. The FM53U film w The recommende these ten were su ton and molding. 253P primer as 1 dules. No primer used. BR53 primer. G	m In film were were were nolding mer a mer a mer. r. use s befo	1 0 > > >	for all of above operations except 3-28-75, which was 2 hr. at 245°F. 253P adhesive was applied and prebaked according to its normal process and used as a tablesive film.  The FM53U film was applied directly to the cleaned projectile surface.  The recommended BR53 primer was us. 4 under the FM53U film.  These ten were subdivided into five groups of two for study of various drying periods atton and molding.  253P primer as in comment #1 above. This group divided into two sets of two for st hedules.  No prime: used. Group divided as in comment #5 for study of two cure schedules.  BR53 primer. Group divided as in comment #5 for study of two cure schedules.  No primer used. This group of twelve subdivided into six groups of two for stidy of schedules before molding.	rectly ter was five grill above ed as in co	d acco	which arding cleane under to two to two s groun ment # f f divided	was 2 lto its	hr. at 245°F normal proceed to the surface of two of two of two of two of two of two ourses ourses of two ourses of two ourses of two ourses of two ourses ours	45°F.  process urface. n. trious two se two curf ps of th	s and us drying F ts of tw re scheet schedul wo for s	5, which was 2 hr. at $245^{\circ}F$ . ccording to its normal process and used as a the cleaned projectile surface.  A under the FM53U film.  ps of two for study of various drying periods  This group divided into two sets of two for study  mment #5 for study of two cure schedules.  ment #5 for study of two cure schedules.	<b>k</b> pr

<u></u>	MOLDING DATA	DATA	N RE	RECOR	n D	Newbury		Eldorado	rado	3V-75RS	SRS				She	Sheet No.	. M14	4,	
Jos Op	Operator		2	Mold		Description	uc			a.	Barrel/Screw	Scr	e w		-	Safety	Safety Check	k Engineer	neer
D.	Pike			R	Rotating	g Band	îđ				Standard	ard				D.	R. As	Askins	
				38 mg	ocrature	1	(OE)		Pres	ress.(psi)	Cycle		mes	Times(sec.)	Screw	308		Feed	Total
Molding Date	Resin	Adhe- sivc	oge oge	əlzz	quo	JE:	No I	)- \ - \	น - <b>-</b> ถอ	ck	uc -၁ə	ocu	Srall	ni m noil	guil	Md	oider (doni	Rate	ખળ
			10J )	No	भ अ	ьЯ	Eix	NoV.	ojul	Вs	olnI oit	ďО	οΛO			ध		color)	(inch
4-14-75	Plaskon 8231	253P	~	500	500	525	091	160	200	125	91	55	120	2-3	13-2. d	120	1/8	Green 3	1-1/8
4-14-75	Plaskon 8231	P3	7		500	525	160	160	500	125	16	55	120	2-3	B-2. d	120	1/8	Green 3	1-1/8
4-15-75	Plaskon 8231	P104	3	500	500	525	160	16.0	500	125	16	55	120	2-3	B-2.0	120	1/8	Green 3	1-1/8
4-15-75	Plaskon 8233	253P	ţ	500	500	525	160	160	600	125	16	55	120	2-3	D-2.0	120	1/8	Green	1-1/8
4-15-75	Plaskon 8233	P3	ς.		<del></del>	525	160	160	009	125	16	55	120	2-3	p-2.0	120	1/8	Green	1-1/8
4-15-75	Plaskon 8233	P104	9	300	9005	525	160	150	009	125	16	55	120	2-3	3-2.0	120	1/8	Green 6	1-1/8
Comi	Comments: Ro 1. 2. 3. 5. 5.	Resin dried 2 h  1. Samples 10  2. Samples 10  3. Samples 10  4. Samples 11  5. Samples 11  6. Samples 11	ried nple nple nple nple		5-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	at 2000F in to 100-6. I to 101-6. I to 102-6. I to 110-6. I to 111-6. I to 112-6. I to 112-6.	6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6	a [] o	fabov	all of above operations	ation	* 9							

	Ī	]	•=	# 1 C	T	T	1			1	1-	
	neex	1	Total	Feed Settin (inch)	1-1/8	1-1/8	1-1/8	00/1-1	1-1/8	1-1/8		
M15	Check Engineer	Askins	Feed	Rate Feed SettingSetting Screw (inch)	Green 3	Green 3	Green 3	Green 3	Green	o o		
	Chec	R. A	u	oidauD (inch)	1/8	1/8	1/8	1/8	1/8	1/16		
Sheet No.	Safety	Ü.	\$¢	мчя	120	120	120	120		40		dhesive dhesive y of two
She			Speed	don M gaitte	B-2.0	B-2.0	B-2. d	B-2.0	B-2.0	B-7.5		idy of a idy
			Times(sec.)	Ram in Motion	٠.	2-3	2-3	3	,	2-3		for stu for stu ssin.
	ew.		imes	Overall	120	120	120	120	120	09		of five of five tent refluse of lass o
	/Screw	lard		Open	55	55	55	55	55	30		roups coups ss con
SRS	Barrel/	Standard	Cycle	-pojal noit	16	16	16	16	16	15		two g two g 7% gla c a 3-1 into fo
3V-75RS	<u>e</u>		Press.(psi)	Васк	125	125	125	125	125	125		tions.  ded inte  ded inte  s give a  1 to giv  divided iparation
Eldorado			Pres	Lajec- roid	500	500	500	500	500	600		Resins dried 2 hr. at 200°F in all of above operations.  1. Samples 120-1 to 120-10. These ten subdivided into two groups of five for study of adhesive application variables.  2. Samples 121-1 to 121-10. These ten subdivided into two groups of five for study of adhesive application variables.  1&2 - Plaskon 8231 mixed 50:50 with Zytel 211 to give a 7% glass content resin.  3. Samples 130-1 to 130-5.  5. Samples 131-1 to 131-5.  5. Samples 132-1 to 132-5.  5. Samples 135-1 to 135-5.  6. Samples 135-1 to 135-12. These twelve subdivided into four groups of three for study of two band two projectile surface preparations. Phaskon 8231 mixed 25:75 with £1501 to give a 3-1/2% glass content.
				Mov- Mov- Side	-	160	160	160	160	250		of aboves ten see ten th Zyt th Zyt see twe see twe see twe see twe
Newbury	noi	pg pg	(£0)	) jaxiq	160	150	150	160	160	250		in all circ. The circ. The circlectification content is a secontent in a second in a secon
	" Mold Description	g Band	ure	Rear	525	525	525	52.5	525	500		As dried 2 hr. at 200°F in all of Samples 120-1 to 120-10. These application variables.  Samples 121-1 to 121-10. These application variables.  Plaskon 8231 mixed 50;50 with Samples 130-1 to 130-5.  Samples 131-1 to 131-5.  Samples 132-1 to 132-5.  b Plaskon 8231 mixed 25;75 w Samples 135-1 to 132-5.  b Plaskon 8231 mixed 25;75 w Samples 135-1 to 135-12. These band langths and two projectiles in give a 3-1/2% glaus content.
RD -	Des.	otating	perature	Front	500	500	500	500	200	500		a dried 2 hr. at 200°F amples 120-1 to 120-1 application variables, amples 121-1 to 121-1 plaskon 8231 mixed 5 amples 130-1 to 130-5 amples 130-1 to 131-5 amples 132-1 to 132-5 b. Plaskon 8231 mixed 5 amples 132-1 to 132-5 b. Plaskon 8231 mixed 5 amples 132-1 to 135-1 band 1 kngihu and 1 kno 150-1 bend 1 kngihu and 1 kno 150-1 bend 1 kno 150-1 20 give a 3-1/2% glass
ECO	Mold	Re	임	Mozzle	500	500	500	500	500	009		application applic
A ·R	<u> </u>	_		Commo			m 0.	4	5	9		 Resins dried 1. Samples 2. Samples 2. Samples 3. Samples 3. Samples 5. Samples 5. Samples 6. Samples 6. Samples 6. Samples
DAT				Adhe- sive	253P	P3	253P	<u>ئ</u> م	P104	253P		 1. 2. 1. 2. 3. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.
MOLDING DATA RECO	erator	Pike		Resin	Plaston 8231 Zytel 211	Plaskon 8231 Zytel 211	Pisson \$231 2):el 211	Placton 8231 2yest 211	Plasson 8231 2ytel 211	Plaston 8231 L1901		Comments:
2	Job Operator	Ü.		Molding Date	5-7-75	5-7-75	5-23-75	5-23-75	5-23-75	6-16-75		Соши

## APPENDIX C TEST DATA

This section presents the results of both falling dart screening tests and gunfire tests conducted upon samples of all the different rotating band/adhesive/processing variable combinations investigated during this program. The information is organized so the reader can cross reference the test results obtained for any single specimen with the processing and molding parameters used in the fabrication of that specimen and tabulated in Appendix B. The notations Pl through Pl4 and Ml through Ml5 refer, respectively, to the sheet numbers upon which the processing or molding data is recorded in Appendix B.

	20 m	m RC	ודאדו	NG B.	AND T	DST DATA		Sheet No. D1
Conbination Number	1 14 5	OWN	Location of Molding Data	of Test	Test Temp. (F ⁰ )	Other Test Data	Observed Test Result	Additional comments on Test Results
2	50-1	121	Ml	Fall.	75		Fail	Bandfractured and debonded from substrate.
2	50-2	Pl	Ml	Fall. Dart	75		Fail	Band fractured and debonded from substrate.
2	50-3	J>J	Ml	Gun Fire	75		Fail	Entire band lost.
2	50-5	Ы	Ml	Gun Fire	75		Fail	Entire band lost.
4	82-3	Pl	Ml	Fall. Dart	75	These seven samples were	Fail	Slight fracturing. Substantial debonding.
4	50-1	pl	Ml	Pall. Dart	75	induction heat- ed to a variety	Fail	Fracture and debonding.
4	70-5	Ρl	Ml	Fall. Dart	75.	of different temps, to en-	Fail	Slight fracturing. Substantial debonding
4	85-1	Pl	Ml	Fall. Dart	75	hance surface wetting. All		Slight fracturing. Substantial debonding.
4	50-5	Pl	· MI	Fall. Dait	75	the samples ultimately saw	Fail	No fracture, some debonding.
4	53-6	[c[	MI	Fall. Dart	75	a max, temp. of 500°F during	Fail	Fracture, complete debonding
4	AG	Pl	1711	Fall. Dart	75	induct. heating	Fail	No fracture, some debonding.
6	53-1	Pl	мі	Fall. Dart	75		Fail	Band fractured and debonded from substrate.
6	53-5	Pl	Ml	Fall. Dart	75			Band fractured and debonded from substrate.
6	53-3	Pl	М	Gun Fire	75		Fail	Entire band lost.
6	53-4	121		Gun Fire	75		Fail	Entire band lost.
7	50-4	Pl	- 341 I	rall. Dart	75	These seven samples were	rail l	Fracture. Substantial debonding.
7	50-6	Pl	Ml	Fall. Dart	75	induct. heated to a variety of		Fracture. Substantial debonding.
7	50-3	Pl		Egil.	75	different temps. to enhance sur-	Fail	Fracture. Substantial debonding
7	70-1	Pl		58lt	75	the samples	F21	Fracture. Substancial debonding.
7	50-2	Pi		Fall. Dart	75	ultimately saw a max, temp.		Fracture. Substantial debonding,
7	70-6	Pl		Fall. Dart	75	or500°F during their various	Fail	Fracture. Substantial debonding.
ż	53-x	Pl		Fall. Dart	75	induct, heating	73	Fracture. Substantial debonding.
8	53-12	Fi	MI	all. Dart	75	SA ROMES	Fail :	Fracture. Substantial debonding.
8	53-2-1	Pi	М	Fall. Dart	75		Fail	Practure. Substantial debonding.
9	60-3	Pl	3.(2)	Pall. Dest	75		F- :1	Band tractured and entirely debonded.
9	50-5	121	MIZ	l'all. Dart	75		Fail	Band fractured and entirely described.
10	20-4	14	M12	Lall. Dart	75		Fail	Slight fracture, Substantial debonding,
10	20-7	12i		Pall. Dait	-65		······································	Fracture and debonding.
10	20-8	11	713	Fall. Dart	75		Pass	No fracture or debonding.
10	10-10	11		Ditt	-65		Fail	Practure and debonding.

	20 1	nm RC	ንፕ ለ ፓህ	NC B	AND T	EST DATA		Sheet No. D2
<u> </u>	Specimen	Locationo: Precessing	Location of Molding Data	Type of Test	Test Temp. (F ⁰ )	Other Test Data	Observed Test Result	Additional comments on Test Results
11	65-	1 P2	M2	Dait	75		Fail	No fracture but entire band debanded.
11	65-	5 P2.	MZ	Fall. Dart	75	Only impacted with 4 ft. lbs. rather than 8.	Fail	No fracture but entire band debonded.
12	65-	1 P2	SM	Fall. Dart	75		Fail	Fracture and complete debonding,
13	10-1	PS	MS	Fall. Dart	75		Pass	
13	10-	P2	Mż	Fall. Dart	-65		Fail	Fracture and partial debonding.
13	10-7	2 P2	M2	Fall. Dart	75		Pass	
13	10-2	P2	M2	Fail. Dart	- 65		Fail	Fracture and partial debonding.
13	10-3	P2	М2	Fall. Dart	75		Pass	
13	10-3	P2	M2	Fall. Dart	-65		Fail	Fracture and partial debonding.
14	10-1	1 P2	М2	Fall. Dart	75		Pass	
14	10-1	1 PZ		Fall. Dart	- 65		Fail	Fracture and partial debonding.
14	10-1	2 P2	M2	Fall. Dart	75		Pass	
14	10-1	2 P2		Fall. Dart	-65		Fail	Fracture and partial debonding.
14-	10-1	5 P2		call. Dart	- ċ5	Only impacted with 2 ft. lbs. instead of 8.	Pass	
15	10-1	7 122	MZ	Fall. Dart	75		Pass	
15	10-1	7 P2	M2	Fall. Dart	- 65		Fail	Fracture and partial debonding.
15	10-1	8 P2	MZ	Fall. Dart	75		Pass	
15	10-1	8 P2	M2	Fall. Dart	-65~		Fail	Fracture and partial debonding.
15	10-1	5य ह	MZ	Call. Dart	- 05	Impacted with 4ft. The, instead of 8.	Fail	Fracture and partial deponding.
15	10-1	9 P2	M2	Pall. Dait		Impacted with 3 it. lbs. instead of 8	Pass	
16	34-	6 P2	М9	Fail. Dart	75		Fail	Fracture and total debonding.
17	33-	4 P2	М9	Fall. Dart	75		Fail	Fracture and substantial debonding.
18	30-	1 P2	М9	rail. Dart	75		Fail	Fracture and partial debonding.
19	31-1	155	М9	call. Dart	75		Fail	Fracture and total debonding.
20	32-5	P2	M9	rall. Dart	75		Fail	Fracture and substantial debonding.
	]							

	20 m	m RC	TATI	NG B	AND T	EST DATA · ·		Sheet No D3
Cambinatian Number	Specimen	Location of Processing	Location of Molding Data	Type of Test	Test Temp. (F ⁰ )	Other Test Data	Observed Test Result	Additional comments on Test Results
21	30-5	P3	мз ,	i'all. Dart	75	Impacted with 2 ft. lb. instead of 8.	Fail	Complete debonding.
22	30-3	P3	M3	Fall. Dart	75		Pass	-
22	30-4	Р3	м3	Gun Fire	75		Fail	Large section lost.
22	30-2	P3	М3	Gun Fire	- 65		Fail	Half of band lost.
22	80-5	P3	М3	Gun Fire	- 65		Fail	Most of band lost.
22	80-6	P3	м3	Gun Fire	165		Pass	Slight fraying on rear edge.
23	50-5	P3	м3	Fall. Dart	75		Pass	
23	80-9	P3	м3	Gun Fire	75		Pass	
23	53-5	P3	м3	Gun Fire	75		Pass	
23	65-4	P3	м3	Gun Fire	75.		Pass	
•								
23	53-4	P3	м3	Gun Fire	- 65		Fail	Small piece off front edge. Rest of band OK.
23	65-5	P3	м3	Gun Fire	- 65		Pass	
23	80-3	<b>P</b> 3	м3	Gun Fire	165		Pass	
23	8 <b>0-</b> 8	P3	м3	Gun Fire	165		Pass	
23.	53-3	P3	м3	Gun Fire	165		Päss	
23	65-6	P3	M3	Gun Fire	165		Pass	
	8 <b>0-1</b> 5		142	Fall. Dart	75		Pass	
24	8 <b>0-</b> 15	P3		Fall. Dart	155		Pass	
24	80-2q	P3		Fall. Dart	75	and the second second	Pass	
24	80-20	Р3		Fall. Dart	-65	and the state of t	Fail	Fracture and partial debonding.
24	80-25	P3	MID I	Fall. Dart	75		Pass	
25	80-28	Р3	M3	Fall. Dart	75	- • -	Pass	
!	80-28	P3		Fall. Dart	-65	<del>-</del>	<b>Pail</b>	Fracture and partial debonding.
25	80-30	P3	M3	Fall. Dart	-65		Marginal	Very slight fracture and debonding.
25	80-35	р3		Fall. Dart	75		Pass	
25	80-35	р3	1013	iall. Dart	-65	<b></b>	Fail	Fracture and partial debonding,
26	82-3	Р3	мз	Fall. Dart	75		Pass	
		]						

	20 in	m RO	TAT	NG B.	AND TI	EST DATA		Sheet No. D4
Cambinatian	Specimen Number	Location of Precessing	Location of Mold.ng Data	Type of Test	Test Temp. (F ⁰ )	Other Test Data	Observed Test Result	Additional comments on Test Results
27	82-3	P3		Dart	75		Pass	
27	82-1	P3	М3	Gun Fire	75	•	Fail	Most of band is lost.
27	82-4	P3	М3	Gun	75		Pass	
27	82-5	₽3	M3	Gun Fire	75		Fail	Rear half of band lost.
27	82-6	P3		Gun Fire	75		Fail	Small pieces lost off rear half of band.
28	85-3	P3	M4	Fall. Dart	1_ 75	Impacted with 13 ft. lb. instead of 8.	Fail	Entire band debonded. No fracture.
28	85-4	<b>p</b> 3	M4	rali. Dart	75	mpacted with 2 ft. lb. instead of 8.	Fail	No fracture. Some debonding.
29	85-1	P3		Fall. Dart	•	Impacted with 4 ft. lb. instead of 8.	Fail	Small amount of debonding. No fracture.
29	85-5	P3	M4	Fall. Dart	75		Pass	
30	85-1	P3		Fall. Dart	75	•	Pass	
30	85-2	P3		Gun Fire	75		Pass	
30	85-3	P3	M4	Gun Fire	75	. <del></del>	Pass	·
30	85-4	P3	M4	Gun Fire	75		Pass	
30	85-5	P3	M4	Gun Fire-	75	. •	Pass	
30	85-6	P3	M4	Gun Fire:	75		Pass	
31	35-13	P3	M4	Fall. Dari:	75		Pass	
31	35 - 17	P3	Ni4	Fall. Dart	75		Pass	
31	35 - 24	P3		Fall. Dart	75		Pass	
3]	35 - 24	P3		Fall. Dart	-65		Fail	Slight fracture and debonding
31	35-23	Р3	M4	Fall. Dart	75		Pass	
31	15-28	РЗ	M4	Fall. Dart	155		Pass	
32	70-5	P4	M5	Fall. Dart	75		Pass	
32	70-7	p4	M5	Fall. Part	75		Fail	Entire-band missing.
32	70-3	P4		Fall. Dart	75	-	Fail	Entire band missing.
32	70-4	b4	M5	Fall. Dart	75		Fail	Entire band missing.
33	75-1	124	M5	Fall. Dart	75		Fail	No fracture but entire band debonded.
34	75-1	Pi	M5	Fall. Dart	75	Impacted with 4 ft. lb. instead of 8.	Fail	some fracture and debonding.
<u></u>							·	

		20 m	n RO	TAT!	NG B	AND T	CST DATA		Sheet No. D5
35   75-5   D4   M5   Sire   75   Fail   Entire band lost	Canbinatian Number	Specimen Number	Location of Precessing	Location of Molding Data		Temp.	Other Test Data	Test	Additional comments on
Second   S	35	75-5	124		Dart	75		Pass	
Several parts of band lost.   Fail   Several parts of band lost.	35	75-3	P4	М5	Fire	75		Fail	Entire band lost.
Solid   P4   M5   Part   75   Fail   Entire band lost.	35	75-6	P4	M5	F1"0	75		Fail	
Section   Pet   MS   Fire   75   Fail   Entire band lost.	36	50-1	p.;	M5	Dart	75		Fail	
75-13   P4   M5   Dart   75   Pass   Facture and partial debonding.	36	'5 <b>-</b> 10	Ī-4	М5	•	75		Fail	Entire band lost.
37   75-12   P4   M5   Fire   75   Pass   Slight fraying at rear edge.	37	75 <b>-</b> 13	P4			75		Pass	
37   75-12   P4   M5   Fire   75   Pass   Slight fraying at rear edge.	37	75 <b>-</b> 13	P4	M5	,	-65		Fail	Fracture and partial debonding.
37   75-14   pd   M5   Fire   75   Pass   Slight fraying at rear edge.	37	75 <b>-</b> 12	P4	M5		75		Fail	Band almost entirely lost.
37   75-15   P4   M5   Fire   75   Pass   Condition of	37	75 <b>-</b> 14	PΔ	M5	Fire	75		Pass	L
38         \$\overline{75}\$-17         \$\text{P4}\$         \$\text{M5}\$         \$\overline{75}\$   \$\overlin{75}\$   \$\overline{75}\$   \$\overline{75}\$   \$\overline{75}\$   \$\	37	75 <b>-</b> 15	P4	M5		75		Pass	
Tracture and debonding	38	75 <b>-</b> 17	P4	M5		75	_	Pass	
38         75-25         P4         M5         Dart   -65         Rb. instead of 8.         Fail   Fracture and debonding.           38         75-25         P4         M5         Dart   -65         Impacted at 4 it.   1b. instead of 8.         Fail   Fracture and debonding.           39         75-30         P4         M5         Dart   -65         Ibs. instead of 8.         Fail   Fracture and debonding.           39         75-40         P4         M5         Dart   -65         Ibs. instead of 8.         Fail   Fracture and debonding.           40         77-6         P4         M6         Dart   -75         Fail   Fracture and debonding.           40         77-8         P4         M6         Dart   -75         Fail   Fracture and partial debonding.           40         77-8         P4         M6         Dart   -75         Fail   Pass           41         77-1         P4         M6         Dart   -75         Fail   Pass           41         77-2         P4         M6         Dart   -75         Fail   Pass	38	75-21	P4			-65		Fail	Fracture and debonding.
39   75-35   P4   M5   Dart   75     Pass     39   75-40   P4   M5   Dart   -65   lbs. instead of 8.   Fail   Gebonding.     40   77-6   P4   M6   Dart   75     Fail   Partial debonding.     40   77-8   P4   M6   Dart   75     Fail   Partial debonding.     40   77-8   P4   M6   Dart   75     Pass     41   77-1   P4   M6   Dart   75     Pass     41   77-4   P4   M6   Dart   75     Pass   Patture and partial debonding.     42   76-1   P5   M6   Dart   75     Pass   Pass     42   76-6   P5   M6   Dart   75     Pass     42   76-3   P5   M6   Dart   75     Pass   Pass     43   76-4   P5   M6   Dart   75     Pass     44   76-7   P5   M6   Dart   75     Pass   Pass     45   76-7   P5   M6   Dart   75     Pass   Pass     46   P5   M6   Dart   75   Pass   Pass   Pass     47   76-8   P5   M6   Dart   75   Pass   Pass   Pass     48   76-7   P5   M6   Dart   75   Pass   Pass   Pass     49   76-7   P5   M6   Dart   75   Pass   Pass   Pass   Pass   Pass     40   76-8   P5   M6   Dart   75   Pass   Pas	38	75-23	P4		( )	-65	b. instead of 8.	Fail	Fracture and debonding.
39   75-35   P4   M5   Dark   75   Pass   Pass	38	75 <b>-</b> 25	P4	М5		<b>~</b> 65	Impacted at 4 ft. lb. instead of 8.	Fail	Fracture and debonding.
39   75-40   P4   M5   Dart   -65   lbs. instead of 8.   Fail   debonding.    -40   77-6   P4   M6   Dart   -75   Fail   Fracture and partial debonding.    -40   77-8   P4   M6   Dart   -75   Fail   Past   Past    -40   77-8   P4   M6   Dart   -75   Fail   Past    -40   77-8   P4   M6   Dart   -165   Pass    -41   77-1   P4   M6   Dart   -75   Fail   Dart   Dart    -41   77-4   P4   M6   Dart   -75   Fail   Pass   Past    -42   76-1   P5   M6   Dart   -65   Fail   Past   Past    -42   76-6   P5   M6   Dart   -65   Fail   Past   Past    -42   76-3   P5   M6   Fire   75   Fail   Past   Past   Past    -42   76-4   P5   M6   Fire   75   Past   Pas	39	75 - 38	P4	M5	Fall.	75	man	Pass	
Fall   Fracture and partial debonding   Fall   Fall   Fracture and partial debonding   Fall	39	75 <b>-</b> 40	p4		1 1	-65	•	Fail	
40   77-8   P4   M6   Dart   75   Fail   Dart   Dart   Pass     41   77-1   P4   M6   Dart   Pass   Facture and   Dart   Dart   Pass     41   77-4   P4   M6   Dart   Pass   Fail   Dart   Pass   Pass     42   76-1   P5   M6   Dart   Pass   Pass   Pass   Pass     42   76-1   P5   M6   Dart   Pass   Pass   Pass   Pass     42   76-6   P5   M6   Dart   Pass   Pass   Pass     42   76-6   P5   M6   Dart   Pass   Pass   Pass     42   76-3   P5   M6   Dart   Pass   Pass   Pass   Pass     42   76-4   P5   M6   Dart   Pass   Pass   Pass   Pass     42   76-7   P5   M6   Dart   Pass   Pass   Pass   Pass   Pass   Pass     42   76-8   P5   M6   Dart   Pass			·		Fall.	75		Fail	Fracture and
10   77-8   P4   M6   Part   -165   Pass   Fracture and partial debonding     41   77-1   P4   M6   Part   75   Pass   Fracture and partial debonding     42   76-1   P5   M6   Part   -65   Pass   Pass   Pass     42   76-6   P5   M6   Part   -65   Pass   Pass     42   76-6   P5   M6   Part   -65   Pass   Pass     43   76-3   P5   M6   Part   -65   Pass   Pass   Pass     44   76-4   P5   M6   Part   -75   Pass   Pass   Pass     45   76-4   P5   M6   Part   -65   Pass   Pass   Pass     46   Past   Pass   Pass   Pass   Pass   Pass     47   76-6   P5   M6   Part   -65   Pass   Pa	40	77-8	p4	N/6	1	-75 -		Fail	
41   77-1   P4   \$6   Part   75   Fail   Partial debonding   Fail.   Partial debonding   Fail.   Partial debonding   Partial	40	77-8	рa	M6		-165 -		Pass	
The fire	41 -	77-1	P4*	X16	Fall.	- 75		Fail	
42   76-1   P5   M6   Dart   75   Pass   Cebonding     42   76-1   P5   M6   Dart   -65   Fail   Fricture and Dartial debonding     42   76-6   P5   M6   Dart   -75   Pass     42   76-6   P5   M6   Dart   -65   Fail   Fail   Pass     42   76-3   P5   M6   Fire   75   Pass   Pass   Pass     42   76-4   P5   M6   Fire   75   Pass   Pass   Pass   Pass   Pass     42   76-7   P5   M6   Fire   75   Pass   Pas	41	77-4	P4	M6	•	75 -		Fail	
42       76-1       P5       M6       Dort -65       -       Fail       Fracture and partial debonding.         42       76-6       P5       M6       Dort -75       -       Pass         -42-76-6       P5       M6       Fall. Part -65       -       Fail       Fracture and portial debonding.         42       76-3       P5       M6       Fire -65       -       Pass       Very small piece lost from rear edge.         42       76-4       P5       M6       Fire -75       Fail       Sever.i small chunks out front and rear.         42       76-7       P5       M6       Fire -75       Fail       One-foirth of band lost.         42       76-8       P5       M6       Fire -75       Fail       Large nece lost.	42	76-1	pr	N16	•	75		Pass	
42       76-6       P5       M6       Fall. Dart       75			<del> </del>	i	Dort	-65			Fracture and partial debonding.
42 76-6 P5       M6 Part -65       Fail       Fricture and partial debonding.         42 76-3 P5       M6 Fire 75       Pass Very small piece lost from rear edge.         42 76-4 P5       M6 Fire 75       Fail Sever.i small chunks out front and rear.         42 76-7 P5       M6 Fire 75       Fail One-foirth of band lost.         42 76-8 P5       M6 Pire 75       Fail Large nece lost.		76-6	P5	N16		75-		Pass	
42       76-3       P5       M6       Fire 75	-42-	76-6	125	N16		-65 ·		Fail	partial debonding.
42       76-4       P5       M6       Fire       75       Fail       Sever, i small chunks off front and rear.         42       76-7       P5       M6       Fire       75       Fail       One-foirth of band lost.         42       76-8       P5       M6       Fail       Large nece lost.		76-3	P5	M6		75		Pass	Very small piece lost from rear edge.
42       76-7       P5       M6       Fire       75       Fail       One-fourth of band lost.         42       76-8       P5       M6       Fail       Large nece lost.	42	76-4	125	M6_		75		Fail	
42 76-8 P5 M6 Pire 75 Fail Large nece lost.	42	76-7	125	346		75		Fail	One-forth of band lost.
	42	76-8	125	N16	Gun Fire	75		Fail	Large nece lost.
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F	7.	15.00	Tu	ING B	AND T	EST DATA		Sheet No. D6
Combination	Specimen	Location	Molding Molding	of Test	Test Temp. (F ⁰)	Other Test Data	Observed Test Result	Additional comments on Test Results
43	76-21	P5	M6	Fall. Dart	75		Pass	
13	76 - 39	P5	м6	Fall. Dart	-65		Fail	Fracture and partial debonding.
43	76-11	P5	М6	Gun Fire	75		Pass	Photo blurred but looks CK
43	76-17	P5	М6	Gun Fire	75		Fail	May be fraving. Small peice off rear edge,
43	76-23	P5	М6	Gun Fire	75		Pass	Photo blurred but looks OK. May have lost small piece.
43	76-26	P5	М6	Gun Fire	75		Pass	Photo blurred but looks OK. May have lost small piece on rear edge.
43	76-30	P5	м6	Gun Fire	75		Fail	Pnoto blurred but some pieces look lost.
44	76 - 36	P5		Fall. Dart	75		Pass	
44	76-35	P5		Fall. Dart	-65 [:]		Fail	Fracture and slight debonding.
44	76 - 37	705	м6	Gun	26			Photo blurred but large
45	76 - 43			Fall. Dart	75 75		Fail	chunk appears missing. Very small chip at rear
45	76 - SI	——i		Fall.		impacted with 4 ft.	Pass	eace. No debonding.
				Dart Fall.		lb. instead of 8. mpacted with 4 it.	Fail	Fracture and debonding. Small cnips at front and rear
	76 - 63			Dart Fall.	75	lb. instead of 8.	Pass	edges. No debonding.
46	76 - 67	P5		Darti Fall.	-65			Fracture and debonding. Fracture and
·	67 - 16		M7	Dart Fall.	75		Fail	partial debonding.
	57 - 16	 -	M7		-55		Fail	Fracture and partial debonding.
47	ó7 - 22	P6	M7	Dart Fall.	75		Fail	Fracture andpartial debonding. Fracture and
48	ó7 - స	P6	M7	Dart	75		Fail	partial debonding.
48	57 - 35	P6	M7 J	Fall. Dart	75		Fail	racture and partial debonding.
49	67 - 45	P6	M7	all. Dart	75	<u>-</u>	Fail	Fracture and partial debonding.
50	<u> </u>	P6	M7]	Pall. Dart	75		_Fail	Fracture and partial debonding.
51	68-2	P6	M7	all. Dart	75		Fail	Fracture and substantial debonding.
51	68-6	Pó	M7 I	Sall. Dirt	75		Fail S	light fracture and debonding
52	B-11	P6		`all.] Dart	75			Fracture and
	∕ε-1(i-	;	rall. Dart	75			partial debonding.
54	(8-41)			Fall. Part	75			substantial debonding.
	8-2,		F	an.	75			partial debonding.
	41 - 1	i-	<u> </u>	ūi.			Fail 1	partial debonding.
	11 - 11 1	-		2111	75		Fail	nartial debonding.
			F	all.	75			partial debonding.
	1 - 15 1		!	all.	75		Fail	partial debonding.
58	2-5 1	77 1	<u>48 D</u>	art	75			partial debunding.

<u> </u>	20 m	m RO	TATI	NG B	V DNV	EST DATA	**************************************	Sheet No. D7
h	<u> </u>	25.50	<u></u>	Τ			<u> </u>	
Canbinatian Number	nou	103 15.55	Location o Molding Data	Type	Test	Other Test Data	Observed Test	Additional comments on -
dio Cir.	3 6	33.55	2000	Test	(F°)	Other rest Data	Result	Test Results
8 %	Spo	34	32.1		\-			
·	1	l	i	rall.	75		Fail	Fracture and
- 59	P11	157	M8	Dart Fall.	75	<u> </u>	Fall	partial debonding. Fracture and
59	2-12	P7	М8	Dart	75	•	Fail	partial debonding.
60	40-8	P7	М8	Fall. Dart	75	!	Fail	Fracture and partial debonding.
61	10-11	P7	мз	Fall. Dart	75		Fail	Fracture and partial debonding.
	 			Fall.			Fall	Fracture and
61	40 - 12	P7	M8	Dart Fall.	75		Fail	partial debonding. No fracture. Very slight
62	13-2	p7	М8	Dart	75		Pass	debonding.
62	43-4	P8		Fall. Dart	75.	•	Fail	Fracture and partial debonding
				Fall.	7.			No fracture.
-63	90-1	F8		Dart Fall.	75		Fail	Partial debonding.
63	90-b	P8		Dart	75		Fail	Partial debonding.
64	v-11	P8	MIO	Fall. Dart	75	•	Pass	
6.4	90 - 15	29.07		Fall. Dart	75	•	T)	
				Call.		***	Pass	Fracture and substantial
04	90 - 19	P8	M10	Dart Fall.	-65		_Fail_	debonding.
64	90 18	P8		Dart	75		Pass	
64	∞-19	P8	M10	Fall. Dart	75		Pass	
64	90-19	P8	M10	Fall. Dart	-65		Fail	Fracture and substantial debonding.
				Fall.				No fracture. Slight
	හ-2 <u>1</u>	P8	M10	Dart Fall.	75		Fail	debonding.
64	90-21	P8	M10	Dart	-65		Fail ·	Fracture and substantial debonding.
64	90-22	P8	M10	Fall. Dart	75		~ Fail	No iracture. Some debonding.
64	10-23	P8	М10	Fall.	75		- Fail	No fracture. Slight debonding.
		-		Fall.				Fracture and substantial
	10-23		M10	Dart Gun	-65		Fail	debonding.
64	<u>v-13</u>	P8	M10	Fire	75	-	Fass	Slight fraying at rear.
	0-14		M10	Gun Fire	75	-	ail	Substantial piece lost.
				Gun		•		Substantial piece lost.
	<u>0-16</u>			Fire Gun	75			
64	<u>17-17</u>	P8	7110	Fire	75		Fail	Substantial piece lost. Fracture and
65	ν-1 3	P8	7110	Fall. Dart	75		Fail	partial debonding.
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5	20 m	m RC	TATI	NG B	AND T	FST DATA		Sheet No. D8
Consination Number	Spacimen Number	Location of	Location of Noiding Data	Type of Test	Test Temp. (F ⁰)	Other Test Data	Observed Test Result	Additional comments on Test Results
	უ. 69	Pŝ	мп	Pan. Dart	75		Pass	
66	90-81	P3	MII	Fall. Dart	-65	Band had 15° and 6° bevela on froct and rear edges.	Fail	Fracture and debonding.
66	70-61	P8	1411	Gun Fire	75		Pass .	
66	70-65	P3	M11	Gen Fire	75		Pass	
66 ·	90-71	P8	мп	Gun Fire Gun	75		Pass	Photo dark, Looks Od but may
66	90-77	P8	M11	Fire	75		Pass	be slight fraying and small pieces lost. Photo blurred. Looks OK but .
66	90 -8 2	1.3	M11	Gun Fire Gun	<u>. 75°</u>	Band had 15° and 6° bevels	Pass	may be slight fraying
	30-64 30	P8	М11	Fire	75	on front and tear edges. Band had 15° and 6° bevels	Pass	·
66	8 <i>3</i> -08	P8	MII	Fire Gun	75	on front and rear edges. Band had 15° and 6° bevels	Pass	
-	90 <i>-</i> 75	P8	MII	Fire Gun	75	on front and rear edges. Band had 15° and 6° bevels	Pass	
66	90-76		M11	Fire Gun	75	on front and rear edges. Band had 15° and 6° bevels	Pass	···
-	90-85	P8	Mll	Fire Gun	75	on front and rear edges. Band had 15° and 6° bevels	Pass	2
1	3 0-62		M11	Fire Gun	-65	on front and rear edges. Rand had 15° and 6° bevels	Pass	.
-	93-66 ~~ ~~		M11	Fire Gun Fire	-65 -65	on front and rear edges. Dand had 150 and 60 bevels	Pass	I awa miana miani
	3 0-72	P8	MII	Gun		on front and year edges. Band had 15° and 6° bevels	Fail	Large piece missing.
<u> </u>	30 - 78	P8	1	Fire Gun Fire	-65	on front and rear edges. Rand had 15° and 6° bevels	Pass	Photo hard to interpret. May be OK or may have lost very
	90-83 90-63	P8	мп	Gun	-65	on front and rear edges. Band had 15° and 6° Sevels	Fail	small piece.
1	20-67	P8 P8	M11 M11	Fire Gun Fire		on front and rear edges. Band had 15° and 6° hevels on front and rear edges.	Pass Fail	Photo dark and blurred. May be OK.
	90-74		MII	Gun Fire		Band had 15° and 6° bevels on front and rear edges.		Photo blurred. Appears to be slight fraying.
	70-80			Gun Fire		Band had 15° and 6° bevels on front and rear edges.	Pass	
,,	20-8 4			Gun Fire		Band had 15° and 6° bevels on front and rear edges-		Photo dark and blurred. May be OK or may have lost very small piece.
	20-04 21-6	j		Fall.	75	on stone and tere vage.	Fail Fail	No fracture. Slight debonding.
	71 -1 0		м10	Fall. Dart	75		Pass	,
10	71 -1 0	P8		Fall.	-65		Fail	Fracture and partial debonding.
	91-5	P8	M10	Fall	-65		Pass	
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	20 m	m RO	TATI	NG B.	AND T	EST DATA		Sheet No. D9
Carrioinatica Number	ц.	0.0		Type of Test	Test	Other Test Data	Observed Test Result	
68_	91 -24	P8	М10	Fall. Dart	75		Pass	
68	91 -2-1	P8	M10	Fali. Dart	-65		Fail	Fracture and partial debonding.
68	0) _23	P8	M10	Gun Fire	75		Fail	No pieces lost but some fraying evident.
68	91 -27	P8	М10	Gun Fire	75		Pass	
68	91 -23	P8	M10	Gun Fire	75		Fail	No pieces lost but limited fraying.
68	91 -34	P8	N110	:	75		Pass	
68	31-17	P8	M10	Gun Fire	75	Rand had 15° and 6° bevels on front and rear edges.	Pass	Photo dark. May be small
68	71 - 1 8	P8	М10		75	Band had 15° and 6° bevels on front and rear edges.	Pass	piece lost from rear edge.
68	11-21	P8	М10	Gun Fire	75	Band had 15° and 6° bevels on front and rear edges.	Pass	
68	11-29	рg		Gun Fire	75	Dand had 15° and 6° bevels on front and rear edges.	Pass	
68	91 -32	P8_	М10		75	Band had 15° and 6° bevela on front and rear edges.	Pass	
68	91 -19	P8	М10		-65	Band had 15° and 6° bevela on front and rear edges.	Pass	Photo dark. May be small piece lost from rear edge.
68	91-26	P8	M10	·	-65	Band had 15° and 4° be, als on front and rear edges.	Fail_	Small piece lost from rear edge.
68	91-30	P8	М10	Gun Fire	-65	Band had 15° and 6° bevelo	Pass	S11
68	91-33	P8	M10	Gun Fire Gun	-65	Band had 15° and 6° bevela on front and rear edges.	Fail	Small piece lost from rear edge.
68	91-1 1	P8	M10	Fire	165	Band had 15° and 6° bevels on front and rear edges.	Pass	Photo dark & blurred. May be
68	91-12	P8	м10		165	Band had 15° and 6° bevels on front and rear edges.	Pass	a few very small pieces lost from rear edge.
68	91-16	P8		Gun Fire		Band bad 15° and 6° bevels on front and rear edges.	Pass	,
68	91-25	Pв	M10	Gun Fire Gun	165	Dand had 15° and 6° bevels on front and rear edges.	Pass	Very slight fraying at
68	91-35	P8	м10		165	Dand had 15° and 6° bevels on front and rear edges.	Pass	rear edge.
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	20 121	n RO	TATI	NG II.	AND T	EST DATA		Sheet No Dl0
Cambinessan Number	r.	0 1	Location of Noteting Data	Typr of Test	Test	Other Test Data	Observed Test Result	Additional comments on Test Results
-	91-60		MIC	Fall. Dart	75		Pass	
69	91-60	Pŝ	M10	Fall. Dart	-65		Fail	Fracture and partial debonding.
69	91-55	P8		Fall. Dart	75		Pass	
69	91-55	P8	M10	Fall. Dart	-65		Fail	Fracture and substantial debonding.
-	91-50		м10	Fall. Dart Fall.	75		Pass	51. 6 - 4
<u> </u>	91-50			Dart	-65	Bandhad 15° & 6° bevels		No fracture. Slight debonding.
	91-41		MIU	Fall. Dart Gun	-03	on front and rear edges.	Fail	Fracture and partial debonding. Photo dark & blurred. May be
69	91-38	P8	M10	Fire	75		Fail	OK but may have lost small niece.
	91-47			Fire Gun	75		Pass	May be tiny fragment
<u> </u>	91-54 91-56			Fire Sun	75 [.]		Pass	off at rear edge.
				Fire Gun		Bandhad 15 & 60 bevels	Pass	Some fraying at rear
)1-43)1-44			Fire Gun		on front and rear edges. Bandhad 150 & 60 bevels	Pass	edge. Some fraying at rear
				Fire		on front and rear edges. Band had lo & 6 bevels	1 4 4 4 4	edge.
)1-52 91-53		M10 M10	Gun Fire		on front and rear edges. Dand had 15% to bevels	Pass	
-	11-57		M10	Gun	75	on front and rear edges. Band nad 15° & 6° bevels	Pass	May be very slight
63)1-47	Pδ		Fire Gun Fire	45	on front and rear edges.	2311	fraying. Small piece lost from
<u></u>)1-45		MIO	ປີແກ	-65	on front and rear edges. Pandhad 150 & 60 bevels	Pass	Photo dark & blurred. May be
69)1-46	PS		Fire Jun Fire		on front and rear edges. Bandhad 15° & o bevels on front and rear edges.	_	small viece off rear edge.
)1-51			77777	65	Bandhad 15° L'6° bevels on front and rear edger.	7	Photo blurred.
69)1-58	P8		Gun Fire	1-	Band had 15° & 6° bevels on front and rear edges.	Pass	Photo blurred.
69)1-37	P\$	M10	Gun Fire	165	Bandhad 15° & '6 bevels on front and rest edges.	Pass	Photo blurred. May be small piece off rear edge.
69	1-39	PS	M10	Gun Fire	165	Band had 150 & 60 bevels on front and rear edres.	Pass	
64)1-40	P8	M10	Jun Fire	105	Band had 150 & objects on front and rear edges.	Pass	Photo blurred. May be small piece off rear edge.
69)1-48	89	M10	Gun Fire	1/-	Bandhad 15° & 6° bevels on front and tear edges.	Pass	
70)2-9	PS	М10	l'all. Dart	75		Fail	Slight fracture and partial debonding.
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-	20 111	m RO	Sheet No. Dil'					
L		T. 201	15.	1	1	1		Sheet No
Cembination Number	Specimen Number	Location o	2.5	of Test	Test Temp. (F ⁰)	Other Test Data	Observed Test Result	Additional comments on Test Results
71	32-12	E-S	MIG	Fall. Dart	75 .	: -	Pass	• • •
1	92-13		м10	Fall. Dart	-65		Pass	
71	92-11	P8	M10	Gun Fire	75		Pass	•
71	92-14	P8 .	M10	Gun Tire	75	•	Pass 🕠	
. 71	92 - 18	P8	M10	Gun	75 .		Pass	•
71	92-19	P8		Gun Fire	75	-	Pass	•
71	92-20	P8	М10	Fire	75		Pass	• • • • • • • • • • • • • • • • • • • •
72	92∸2:	P8	MII	Fall. Dart	75		Pass	• • • • • • • • • • • • • • • • • • • •
	92-21			Gun	75	-:	Fail	Photo dark but appears to have lost part of band.
- 72	92-20	P8	МΩ1	Gun Fire	75		Fail	Photo dark but some pieces may be off & some fraving.
•72	92-30	P8	MII	Gun Fire		··	Fail	band appears to have bec os:
72	92-25	P8	MII	Fire	75	Bandhad 15° & 6° bevels on front and rear edges.	Pass ·	•
-72	92-29	P8 -	МП	Gun Fire	75	Band had 15° & 6° bevels on front and rear edges	Pass .	•
72	92-35	РЗ	Mll	Gen		Sand had 15° it of pevels on front and rear edges.	Pass	
72	72-39	P8	MII	Gun Fire	75	pana had 150 & obevels on front and rear edges.	Pass	
72)2 <u>.</u> 45	РЗ	MII	Gun Fire	75	Band had 15° & 6° bevels on front and rear edges.	Pass	• • • • • • • • • • • • • • • • • • • •
-72.	9 2- 22	P3	-Mll	Gun Fire	-65	Handhad 15 & 6 bevels on front and rear ectes.	Fail	Piece of band missing.
-72	72-27	P8-	Mll	Gun	65	Fandhad 15" & 6" bevels	Fail	Almost catire band lost.
72	32 - 32	Pŝ	MII	Gun	-ć5	Sand had lov & ov ocvels on front and rear cozes.		
- 72	72-37	P8	Mll	Gen Fire	-65	Band had 15° & 6° bevels on front and rear edges.		Piece missing from rear half of band.
- 72)2 – 47	P8		Gun Fire	65	Bandhad 15° & 5° bevels on front and rear edges.	Pass	•
72)2-2:	PS	Mil	Gun Fire	165	Bandhad 15° 2 6° bevels on front and rear adges.	Fail .	Photo dark but looks like a piece is missing.
72)2-28	PS	MII	Gun	165	Bandhad 15" & 60 bevels on front and rear edece	Fail ·	Photo blurred but large piece appears to be missing.
72)2-38	PS	MII	Gun Fire	165	Bandicad 15" to o bevels on front and rear edges.	Fail	Badly peeled.
72)2-1:	PS		Gun Fire	lóś	Bandhadlo & u bevels on front and rear edges.	Fail	Photo dark and blurred. May be OK.
73	72-19	PS	1 1 1 1 1	Fail. Dart	-65	Impacted with 4 it. 1b. instead of S.	Fail	Fracture and partial debonding.
73	72-50	PSS	MII	Fall. Dari	65		Fail	Fracture and partial debouding.
. 74)3-3	129	мп	l'all. Dart	75	··	Fail	Fracture and debonding at primer-projectile interface.
74	93-3	1'9	мп	Fall. Dart	-65		Fail	Fracture and debonding at primer-projectile interpress.
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	20 in	m RO	TATI	NG B.	AND T.	EST DATA		Sheet No. DIZ
15		4.5					T	
Combination Number	Specimer Number	Location Pressi	Locationo Moléing Data	Type of Test	_ • '	Other Test Data	Observed Test Result	Additional comments on Test Results
75	34-5	Р9	MH	Fall. Dart	75		Pass	
75	94-5	Ъò	MII	Pall. Dart	-65		Fail	Fracture a substantial debond- ng at adhesive-plastic interface
76	95-1	<u>5</u> 9	MII	Fail. Dart	75		Fail	No fracture. Substantial debonding.
76	95-1	૧૧	MII	Fall. Dort	- 65		Fail	Fracture & complete debonding at both metal Eplastic interfaces
76	95-3	P9	Mlı	Fall- Dart			Fail	No fracture. Substantial debonding.
76	95-3	рg	Mll	Fall. Dart	-65		Fail	Fracture & complete debonding at both metal plastic interface:
77	69-9	Ρ9	М7	Fall. Dart	75		Fail	Fracture and
78	59 - 15	P9	м7	Fall. Dart	75		Fail	Fracture and partial debonding.
79	69-20	فط	`:7	Fall. Dart	75		Fail	Fracture and slight debonding.
80	39-23	P9	м7	Fall. Dart	75		Fail	Fracture and partial debonding.
- 81 -	21-2	P10	M12	Fall. Dart	75		ran	Fracture and deponding at plastic-adhesive interface.
-81	21-3	P10	M12	Fall. Dart	75		I Fail	Fracture and deponding at plastic-adhesive interface.
.81	21-1	P10	M12	Fall. Dart	-65		l ran	Fracture and deponding at plastic-adhesive interface.
82	21-5	P10	М12	Fall Dart	75			Fracture and devencing at plastic-adhesive interface.
82	21-6	P10	M12	Pall. Dart	75		1 211	Fracture and deponding at classic-adirection interface.
.82	21-4	P10	M12	Fall. Dart	-65			Fracture and deponding at plastic-adhesive interface.
83	21-8	Pl0	M12	• •	75			Fracture and debonding at blastic-adhesive interface.
-83	21-7	P10	MIZ	Dari	- 65		Fail	Fracture and deponding at plastic-adhesive interface.
-84	21-11	P10	N112	Fall Dart	75		Fail	Fracture and deponding at olastic-adhesive interface.
- 84-	21-10	1910	M12	l'all. Dart	- 55		Pair	Fracture and deponding at plastic-adhesive interface.
-85	21-14	P10	M12	l'all. Dart	75		Fail	Fracture and deponding at plastic-adhesive interface.
85	21-13	P10	Miz	Fall. Dart	-65			Fracture and debonding at plastic-adhesive interface.
86	21-17	P10	M12_	Fall Dart	75		Fail	Fracture and deponding at plastic-adherive interface. Fracture and according at
86	21-16		M12		-65		Fail	Fracture and acconding at plastic-adhesive interface.
87	21-19	1510	MIZ	Fall. Dort	75		Fail	No fracture. Very slight depond- ing at plastic-adhesive interiac.
87	21-20	7210	M12	, ell. Dart	-65		Fail	No fracture. Very slight debond- ing at plastic-adhesive interface.
88	21-21	1210	M12	Fall Dait	75		Fail	No fracture. Very slight debond- ing at plastic-adhesive interface.
88	21-22	1710	A112	i'all Darl	- 65		Fail	No fracture. Very slight Cobonding at plastic-adhesive interface.
89	21-23	1210	7115	Dut	75		Fail	No fracture. Very slight debond-
89	21-24	1'10	MIZ	Tah Dart	-65		Fail	No tracture. Very stight debonding at plastic-adhesive interface.

	20 m	m RO	TATI	Sheet No. D13				
Combination Number	Specimen Number	Location of Precessing	Location of Molding Data	Type of Test	Test Temp. (F ⁰)	Other Test Data	Observed Test Result	Additional comments on Test Results
90	21-25	P10	M12	Dart	75		Fail	No fracture. Very slight debond- ing at plastic-adhesive interface.
90	21-26	P16		Fall. Dart	-65		Fail '	No fracture. Very slight debond- ing at plastic-adhesive interface.
91	21-27	1510		Fall. Dart	75		Fail	No fracture. Very slight debond- ing at plastic-adhesive interface.
91	21-28	P10	M12	Fall. Dart	-65		Fail	Fracture & devonging at primer-metal interface.
92	21-29	P10	M12	rail. Dart	75		Fail	No fracture. Very slight depond- ing at plastic-adhesive interface.
92	21-30	P10		Fall. Dart	- 65		Fail	Fracture and debonding at plastic-adhesive interface.
93	21-31	Pll	Ml2	Fall. Dart	75		Fail	Fracture and delonding at plastic-adhesive interface.
94	21 - 34	Pil	Ml2	Dari	75		Fail	Fracture & total deponding at plastic-adhesive interface.
95	21-35	Pll	Ml2	Fall. Dart	75		Fail	Fracture & partial debonding at plastic-adhesive interface. Fracture & partial according
96	21-37	Pll		Fall. Dart	75		Fail	at plastic-adhesive interface.
·97	21-39	Pll	Ml2	Fall. Dart	75		Fail	Fracture & partial debonding at plastic-adhesive interface.
98	21-42	Pll	MIZ	Fall. Dart	75		Fail	Fracture & partial deponding at plastic-adhesive interface.
- 99	22-2	Pll		Fall. Dart	75	1	Fail	Fracture and debonding.
99	22-1	Pll	MIZ		- 65		Fail	Fracture and debonding.
100	22-4	PII	M12	Fall. Dart	75		Fail	No fracture. Very slight debonding.
100	22-3	PII	M12	Fall. Dart	-65		Fail	Fracture and debonding.
101	22-6	Pll	M12	Fall. Dart	75		Fail	No fracture. Very slight debonding.
101	22-5	Pll	M12	Fail. Dart	- 65 I	·· · · · · ·	Fail	Fracture and debonding.
102	22-8	Pll	M12	Fali. Dart	75		Fail	No tracture. Very slight debonding.
102	22-7	Pll		Fall. Dart	-65		Fail	Fracture and debonding.
103	7.2-10	PII	MIZ	r all. Dart	75		Fail	No fracture. Very slight debonding.
103	22-9	1711	MIZ	Fall. Dart	- 65		Fail	Fracture and debonding.
104	23-1	PIZ	1413	Fall.	75		Pass	·
104	23-1	Pl2		Fall. Darti	- 65		Fail	No Fracture. Very slight debonding.
104	23-2	1912		Pall. Dart	- 65	, , , , , , , , , , , , , , , , , , ,	Fail	Fracture & debonding at metal-adhesive interface.
105	23-5	1912	M13	Fall. Dart	75		Pass	
<u> </u>	23-5		M13	Fall. Part	65		Fail	Debonding at metal- adhesive interface.
106	23-7	142		Tall. Dart	75	. ,	rail	Fracture a very slight debond- irg at metal-adhesive interface
106	23-7	צויו	M13	Call. Dart	- 65		Fail	Fracture a very slight debond- ing at metal -adbesive interfac
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| Type Test Other Test Data Test Additional comme Test Result ar
face.
l debond-
interface |
|--|---------------------------------------|
| 107 23-9 P12 M13 Dart 75 Pass 107 23-9 P12 M13 Dart -65 Fail Fracture & debonding metal-adhesive inter 108 23-13 P12 M13 Dart -65 Pass 108 23-13 P12 M13 Dart -65 Fail Ingat metal-adhesive 109 23-14 P12 M13 Dart -65 Pass 109 23-14 P12 M13 Dart -65 Pass 110 24-1 P12 M13 Dart -75 Pass Very slight debonding 110 24-1 P12 M13 Dart -65 Fail Fracture & substantia 110 24-1 P12 M13 Dart -65 Pass Very slight debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 Pass | ldebond-
interface |
| 107 23-9 P12 M13 Dart -65 Fail metal-adhesive inter 108 23-13 P12 M13 Dart -75 Pass 108 23-13 P12 M13 Dart -65 Fail ingat metal-adhesive 109 23-16 P12 M13 Dart -75 Pass 109 23-16 P12 M13 Fail -65 Fail ingat metal-adhesive 110 24-1 P12 M13 Dart -75 Pass Very slight debonding 110 24-1 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 P12 P13 P13 | ldebond-
interface |
| 108 23-13 P12 M13 Fall. -65 Fail Fracture & substantial ing at metal-adhesive 109 23-16 P12 M13 Dart 75 Pass 109 23-16 P12 M13 Fall. -65 Fail Fracture & substantial ing at metal-adhesive 110 24-1 P12 M13 Dart 75 Pass Very slight debonding 110 24-1 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding -65 Fail Fail -65 Fai | interface |
| 108 23-13 Pl2 M13 Dart -65 Fail ing at metal-adhesive 109 23-16 Pl2 M13 Fail. Dart -55 Pass Fail Fracture & substantia ing at metal-adhesive 110 24-1 Pl2 M13 Fail. Dart 75 Pass Very slight debonding 110 24-1 Pl2 M13 Fail. Dart -65 Fail Fracture and debonding at both interfaces. 110 24-2 Pl2 M13 Fail. Dart -65 Fail Fracture and debonding at both interfaces. | interface |
| 109 23-16 P12 M13 Dark 75 Pass | |
| 110 24-1 P12 M13 Dart 75 Pass Very slight debonding 110 24-1 P12 M13 Dart -65 Pail Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding 110 24-2 P12 M13 Fall. | |
| 110 24-1 P12 M13 Dart 75 Pass Very slight debonding 110 24-1 P12 M13 Pall Pass interface |
110 24-1 F12 M13 Dart -65 Fail at both interfaces. 110 24-2 P12 M13 Dart -65 Fail Fracture and debonding the both interfaces.	ÿ: <u>.</u>
110 24-2 Pl2 M13 Dart -65 Fail at both interfaces.	ng
	ng
110 24-5 P12 M13 Fall. 165 Pass Very slight debonding	•
111 24-6 Pl2 M13 Dart 75 Pass Very slight debonding	g <u>.</u>
111 24-7 P12 M13 Fall65 Fail Fracture and debondi	
112 24-8 P12 M13 Fall. 75 Pass Plastic-adhesive inter	at
112 24-9 F12 M13 Fall65 Fail Fracture and debondi metal-adhesive inter-	lace.
113 24-10 Pl2 M13 Fall. 75 Pass Very slight debonding both interfaces.	at
113 24-11 Pl2 M13 Dart 75 Pass Very slight debonding poth interfaces.	at
113 24-12 P12 M13 Dart -65 Pass both interfaces.	gat
114 24-13 P12 M13 Dart 75 Fail Debonding at metal-	
114 24-14 P12 M13 Fail. 75 Fail Debonding at metal-adhesive interface.	
114 24-15 P12 M13 Fail -65 Fail Debonding at metal-adhesive interface.	
115 100-4 P13 M14 Fall. 75 Fail Fracture and debonding metal-adhesive interf	
115 00-1 P13 M14 Dart 165 - Fail metal-adhesive interf	ng at
116 01-3 P13 M14 Dart 75 Fail plastic-adhesive inter	ng at
116 O1-4 P13 M14 Part 165 Fail Plastic-adhesive inter	ng at
117 02-7 P13 M14 Fall. 75 Fail Fracture and debonding plastic-adhesive inter	ng at
117 02-3 P13 M14 Fall. 165 Fail Fracture and debonding plastic-adhesive inter	ng at
118 10-4 P13 M14 Dart 75 Fail Fracture and debonding plastic-adhesive inter-	ng at
118 10-6 P13 M1-1 Dart 165 - Fail plastic-adhesive inter	face.
	
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	20 211	ın RC	TATI	Sheet No. D15				
Centination Number	Specimen	Location of Precessing	Location of Neicing Data	Type of Test	, , ,	Other Test Data	Observed Test Result	Additional comments on Test Results
119		. Pl3		Fall. Dart	75	,	Fail	Fracture & debonding at plastic-adhesive interface.
119	111-5	P13	M14	Fall. Dart	75		Fail	Fracture and debonding at plastic-adhesive interface.
119	111-1	P13	M14	Fall. Dart	165		Fail	Fracture and debonding at . plastic-adhesive interface.
119	111-4	P13	MI-J	Fall. Dart	165		Fail	Fracture and debonding at plastic-adhesive interface.
120	112-1	P13	M14	Fall. Dart	75		Fail	Fracture and debonding at plastic-adhesive interface.
120	112-6	P13	MI4	Fall. Dart	165		Fail	Fracture and debonding at plastic-adhesive interface.
121	120-3	P13	M15	Fall.	75		Pass	
121	120-3	P13	M15	Dart	-65	•	Fail	No fracture. Debonding at both interfaces.
122	120-7	P13	M15	Fall. Dart	75		Pass	
-122	120-7	P13	Ml5	Fail. Dart	-65		Fail	Fracture and debonding at both interfaces.
123	130-3	P13	М15	Fall. Dart	75		Pass	
123	130-3	P13	M15	Fall. Dart	-65		Fail	Fracture and debonding at both interfaces.
-123	130-5	P13	M15	Fail. Dart	165		. Pass	
124	121-4	P14	M15	Fall. Dart	75		Fail	Fracture and debonding at plastic-adhesive interface.
124	121-4	P14	M15	Fall. Dart	-65		Fail	Fracture and deponding at plastic-adhesive interface.
-125	121-7	.P14	М15	Fall. Dart	- 75.		Fail	Fracture, some deconding at both interfaces, but most at metal-adhesive.
. 125	121-7	Pl4	M15.	Fall. Dart	-65_		Fail	Fracture, some covonging at both interfaces, out most at metal-adhesive.
726	131-2	Pl4	M15	Fall. Dart	75		Pass	
L	131-2		!	Fall. Dart	-65		Fail '	Fracture and debonding at plastic-adhesive interfaces.
756	1313	P14	M15	Fali. Dart	_165		Pass	
127	132-2	Pl4	M15	Fall. Dart	75		Pass	
127	132-2	Pl4	M15	Fall. Dart	-65		Fail	Fracture and debonding at plastic-adhesive interface.
127	132-4	Pl4	N115	Fall. Dart	75		Fail	Fracture and debonding.
127	132-3	P14		Fall. Dart	- 165		Pass	
128	135-1	P).i		Fall. Dart	. 75		Pass	
128	135-2	PH	MIS	Fall. Dart	-65	Impacted at 2 ft. lb. usicad of S.	Fail.	Fracture and debonding.
128	135~3	P14		Fall. Dart		impacted at 2 it. lb.	Fail	Fracture and debonding.
129	135-1	PM	MI5	Fall. Dart	75	Impacted at 2 ft. lb.	Fail	Fracture and debonding.
129	35-5	1214	7112	Fall. Dart		Impacted at 2 ft. lb. instead of 3.	Fail	Fracture and debonding.
129	135-6	121-1		Fall. Dart		Impacted at 2 ft. ib.	Fail	Fracture and debonding.

1	20 m	m RO	TATI	NG 13.		Sheet No. D16		
Number Number	Specimen Number	Location of Processing	Location of Moiding Data	Typc of Test	Test Temp. (F ⁰)	Other Test Data	Observed Test Result	Additional comments on Test Results
	135-7	Pl4	M15	Fall. Dart	. 75	·	Pass	
130	135-8	P14	M15	Fall. Dart	-65	impacted at 2 st. lb. instead of 8.	Fail	Fracture and debonding.
130	135-9	Pl4	M15	Fall. Dart	-65	Impacted at 2 ft. 1b. instead of 8.	Fail	Fracture and debonding.
131	135-10	Pl4	M15	Fall. Dart	75	Impacted at 2 (t. 1b. instead of 8.	Fail	Fracture and debonding.
131	35-11	Pl∉	M15	Fall. Dart	-65	Impacted at 2 ft. 1b. instead of 8.	Fail	Fracture and debonding.
131-	135-17	P14	MIS	Fall. Dart		Impacted at 2 ft. 1b. instead of 8.	Fail	Fracture and debonding
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